

PB89-139349

Best Demonstrated and Available
Technology (BDAT) Background Document for
K028, K029, K095, K096 (Proposed)

(U.S.) Environmental Protection Agency
Washington, DC

28 Dec 88



U.S. Department of Commerce
National Technical Information Service

NTIS

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/530-SW-89-017M	2.	3. Recipient's Accession No. PB89 139349/AS
4. Title and Subtitle BEST DEMONSTRATED AND AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR K028, K029, K095, K096 (PROPOSED)			5. Report Date 12/28/88
7. Author(s) LISA JONES/JIM BERLOW/OSW			6.
9. Performing Organization Name and Address U.S. EPA OFFICE OF SOLID WASTE 401 M STREET, SW WASHINGTON, DC 20460			8. Performing Organization Rept. No.
12. Sponsoring Organization Name and Address			10. Project/Task/Work Unit No.
			11. Contract(C) or Grant(G) No. (C) (G)
			13. Type of Report & Period Covered PROPOSED BACK. DOC. 12/88
15. Supplementary Notes			14.

16. Abstract (Limit: 200 words)

This background document provides the Agency's rationale and technical support for selecting the proposed constituents to be regulated in K028 waste and for developing proposed treatment standards for these constituents. This background document also provide the Agency's rationale and technical support for proposing a standard of "No Land Disposal Based on No Generation" for all K029 nonwastewaters and a standard of "No Land Disposal Based on Recycling" for all K095 and K096 nonwastewaters. The Agency is not proposing treatment standards for wastewater forms of K029, K095, or K096. The Agency may develop such treatment standards prior to May 8, 1990 if there is an identified need for such standards (i.e., if wastewater forms of the listed wastes are proven to be generated).

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement

RELEASE UNLIMITED

(See ANSI-Z39.18)

19. Security Class (This Report)	21. No. of Pages
UNCLASSIFIED	104
20. Security Class (This Page)	22. Price MF
UNCLASSIFIED	P002195/86.95

 OPTIONAL FORM 272 (4-77)
 (Formerly NTIS-35)

PROPOSED
BEST DEMONSTRATED AND AVAILABLE TECHNOLOGY (BDAT)
BACKGROUND DOCUMENT FOR
K028, K029, K095, K096

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December 28, 1988

CBI-20
1107-05.nvj.1

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

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In accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) enacted in the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984, the Environmental Protection Agency (EPA) is proposing to establish best demonstrated available technology (BDAT) treatment standards for the listed wastes identified in 40 CFR 261.32 as K028, K029, K095, and K096 from the production of 1,1,1-trichloroethane. Compliance with these BDAT treatment standards is a prerequisite for placement of these wastes in units designated as land disposal units according to 40 CFR Part 268. The BDAT treatment standards will be effective as of June 8, 1989.

This background document provides the Agency's rationale and technical support for selecting the proposed constituents to be regulated in K028 waste and for developing proposed treatment standards for these constituents. This background document also provides the Agency's rationale and technical support for proposing a standard of "No Land Disposal Based on No Generation" for all K029 nonwastewaters and a standard of "No Land Disposal Based on Recycling" for all K095 and K096 nonwastewaters. The Agency is not proposing treatment standards for wastewater forms of K029, K095, or K096. The Agency may develop such treatment standards prior to May 8, 1990 if there is an identified need for such standards (i.e., if wastewater forms of the listed wastes are proven to be generated). Wastewater forms of these wastes are expected to be generated from a few sources such as leachate collected from

landfills and other land disposal units that contain previously disposed K029, K095, and K096 wastes.

Also included is waste characterization information that serves as a basis for determining whether variances from a treatment standard may be warranted for a particular waste that has characteristics such that the particular waste is more difficult to treat than the wastes that were analyzed in developing the treatment standards for these wastes.

The Agency's legal authority and promulgated methodology for establishing treatment standards and the petition process necessary for requesting a variance from the treatment standards are summarized in an EPA document entitled Methodology for Developing BDAT Treatment Standards.

This background document presents the following waste-specific information: the number and locations of facilities affected by the land disposal restrictions for K028, K029, K095, and K096; the processes generating the wastes; the waste characterization data; the technologies used to treat the wastes (or similar wastes, if any); and the treatment performance data on which the proposed treatment standards are based, if appropriate. This document also explains EPA's determination of BDAT, selection of constituents to be regulated, and calculation of proposed treatment standards.

Under 40 CFR 261.32, waste codes K028, K029, K095, and K096, which are generated in the production of 1,1,1-trichloroethane, are listed as follows:

- K028: Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane;
- K029: Waste from the product steam stripper in the production of 1,1,1-trichloroethane;
- K095: Distillation bottoms from the production of 1,1,1-trichloroethane; and
- K096: Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane.

The four digit Standard Industrial Classification (SIC) code associated with the production of chlorinated organic chemicals is 2869. The Agency believes that there are three facilities on the United States manufacturing 1,1,1-trichloroethane that could potentially generate these listed wastes.

The Agency is proposing to regulate ten organic constituents and four metal constituents in K028 wastewaters and nonwastewaters. For the purpose of determining the applicability of the proposed treatment standards, wastewaters are classified as wastes containing less than 1 percent (weight basis) total suspended solids* (TSS) and less than 1 percent (weight basis)

*The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, total suspended solids is measured by method 209C (Total suspended solids dried at 103-105°C) in Standard Methods for the Examination of Water and Wastewater, American Public Health Association, American Water Works Association, and Water Pollution Control Federation, Sixteenth Edition.

total organic carbon (TOC). Wastes not meeting this definition are classified as nonwastewaters.

The Agency does not have any performance data for treatment of K028. A treatment performance test for this waste has not been pursued because the Agency believes that adequate treatment performance data are available from similar wastes previously tested by the BDAT program. Therefore, treatment performance data were transferred from other previously-tested wastes to develop treatment standards for K028 nonwastewaters and wastewaters. The proposed BDAT treatment standards for organic constituents in K028 nonwastewaters are based on treatment performance data transferred from the ash residual from incineration of F024. The proposed BDAT treatment standards for metal constituents in K028 nonwastewaters (and F024 nonwastewaters) are based on performance data from stabilization of ash from the incineration of K048 and K051.

For K028 wastewaters, the proposed BDAT treatment standards for the organic constituents are based on treatment performance data for the scrubber water residual from incineration of F024. Treatment standards for metal constituents in K028 wastewaters (and F024 wastewaters) are based on treatment performance data from treatment of K062 mixed with metal-bearing characteristic wastes by chemical precipitation and sludge dewatering.

Since the Agency is proposing a standard of "No Land Disposal" for K029, K095, and K096 nonwastewaters, numerical standards were not developed

for these wastes; thus, treatment performance data were not transferred from previously-tested wastes.

The tables following this section list the specific proposed BDAT treatment standards for K028, K029, K095, and K096. The treatment standards for K028 reflect the total concentration of each organic constituent being proposed for regulation in K028 nonwastewaters and the total concentration of each metal and organic constituent being proposed for regulation in K028 wastewaters. The treatment standards for metal constituents in K028 nonwastewaters are based on analysis of leachate obtained by use of the Toxicity Characteristic Leaching Procedure (TCLP) found in Appendix I of 40 CFR Part 268. The units for total constituent concentration are in mg/kg (parts per million on a weight-by-weight basis) for nonwastewaters and in mg/l (parts per million on a weight-by-volume basis) for wastewaters. The units for leachate analysis are in mg/l (parts per million on a weight-by-volume basis). If the concentrations of the proposed regulated constituents in K028, as generated, are lower than or equal to the proposed treatment standards, then treatment of K028 is not required prior to land disposal.

PROPOSED BDAT TREATMENT STANDARDS FOR K028
NONWASTEWATERS

	Maximum for any Single Grab Sample
<u>Organic Constituents</u>	<u>Total Concentration (mg/kg)</u>
1,1-Dichloroethane	0.014
trans-1,2-Dichloroethene	0.014
1,1,1,2-Tetrachloroethane	1.9
1,1,2,2-Tetrachloroethane	1.9
Tetrachloroethene	0.014
1,1,1-Trichloroethane	0.014
1,1,2-Trichloroethane	0.014
Hexachlorobutadiene	2.7
Hexachloroethane	1.8
Pentachloroethane	1.9
<u>Metal Constituents</u>	<u>TCLP Leachate Concentration (mg/l)</u>
Chromium (total)	1.7
Nickel	0.048

PROPOSED BDAT TREATMENT STANDARDS FOR K028
WASTEWATERS

Maximum for any
Single Grab Sample

<u>Organic Constituents</u>	<u>Total Concentration</u> <u>(mg/kg)</u>
1,1-Dichloroethane	0.014
trans-1,2-Dichloroethene	0.036
1,1,1,2-Tetrachloroethane	0.014
1,1,2,2-Tetrachloroethane	0.014
Tetrachloroethene	0.014
1,1,1-Trichloroethane	0.014
1,1,2-Trichloroethane	0.014
Hexachlorobutadiene	0.014
Hexachloroethane	0.036
Pentachloroethane	0.014

<u>Metal Constituents</u>	<u>Total Concentration</u> <u>(mg/l)</u>
Cadmium	6.4
Chromium (total)	0.35
Lead	0.037
Nickel	0.47

PROPOSED BDAT TREATMENT STANDARDS FOR K029
NONWASTEWATERS

NO LAND DISPOSAL BASED ON NO GENERATION

PROPOSED BDAT TREATMENT STANDARDS FOR K095 AND K096
NONWASTEWATERS

NO LAND DISPOSAL BASED ON RECYCLING

PROPOSED BDAT TREATMENT STANDARDS FOR K029, K095, AND K096
WASTEWATERS

STANDARDS ARE DEFERRED

2.0 INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

The Hazardous and Solid Waste Amendments (HSWA) specify dates after which particular groups of hazardous wastes will be prohibited from land disposal. The amendments also require the Environmental Protection Agency to establish treatment standards for each waste that, when met, will allow that waste to be land disposed. Wastes generated in the production of 1,1,1-trichloroethane are part of the second-third of the scheduled listed wastes to be evaluated by the Agency for land disposal restrictions. The purpose of this section is to describe the industry affected by the land disposal restrictions for K028, K029, K095, and K096 and the processes generating the wastes, and to present available waste characterization data.

Wastes identified as K028, K029, K095, and K096 are specifically generated by the 1,1,1-trichloroethane manufacturing process and are listed in 40 CFR 261.32 as follows:

K028: Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane;

K029: Waste from the product steam stripper in the production of 1,1,1-trichloroethane;

K095: Distillation bottoms from the production of 1,1,1-trichloroethane; and

K096: Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane.

2.1 Industry Affected and Process Description

Three facilities in the United States are known to generate K028, K029, K095, or K096. These facilities, their locations, the EPA Regions in which they are located, and the waste codes generated are listed below. None of the facilities currently generates K029.

Facilities Generating K028*

<u>Facility</u>	<u>Location</u>	<u>EPA Region</u>	<u>Wastes Generated</u>
Dow Chemical Company, U.S.A.	Freeport, TX	VI	K028
PPG Industries, Inc.	Lake Charles, LA	VI	K028, K095
Vulcan Materials Co.	Geismar, LA	VI	K028, K096

1,1,1-Trichloroethane is produced commercially by the catalytic hydrochlorination of vinyl chloride. A simplified flow diagram illustrating the 1,1,1-trichloroethane manufacturing process and the generation for K028, K029, K095, and K096 is presented in Figure 2-1. Vinyl chloride and hydrogen chloride are reacted in the presence of a ferric chloride catalyst to produce 1,1-dichloroethane intermediate. Spent catalyst is separated from the product stream via filtration or distillation. The spent catalyst stream is the listed waste K028. The 1,1-dichloroethane intermediate is then reacted with chlorine to produce 1,1,1-trichloroethane. Heavy ends from the heavy ends

*Source: 1987 Directory of Chemical Producers - United States of America (Reference 5).

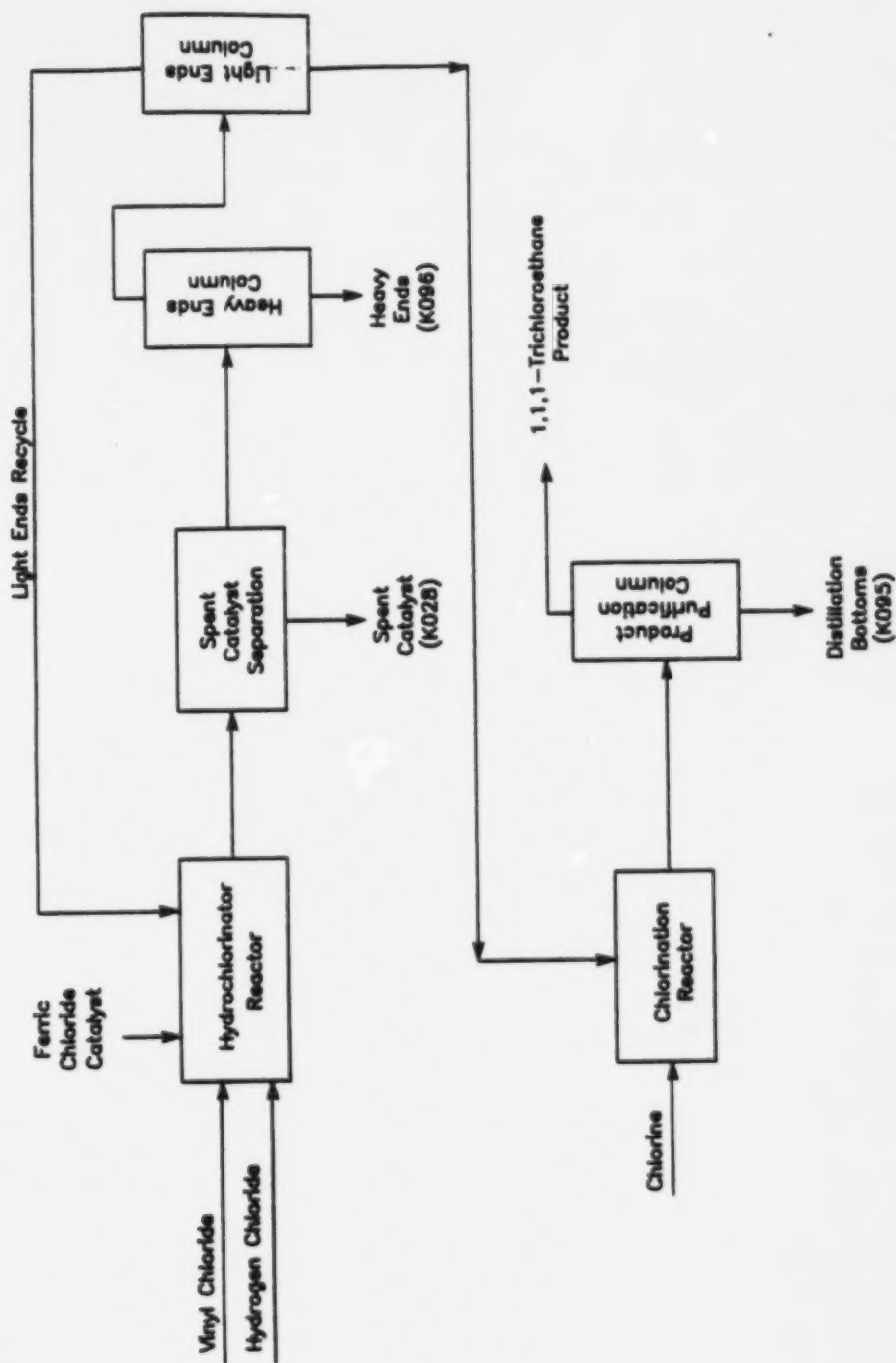


Figure 2-1. Simplified Flow Diagram for Production of 1,1,1-Trichloroethane

column, if used, comprise K096. The heavy ends column is generally placed prior to the secondary chlorination reactor. Distillation bottoms from the final purification of 1,1,1-trichloroethane product comprise K095. Although not currently generated, K029 is generated as a steam stripper waste in processes where a steam stripper is used prior to final distillation and recovery of 1,1,1-trichloroethane.

2.2 Waste Characterization

K028 generally contains greater than 50 percent chlorinated organic constituents, with the balance of the waste comprised of heavy tars and ferric chloride catalyst. Tables 2-1, 2-2, and 2-3 contain the ranges of BDAT List constituents (volatiles, semivolatiles, metals, and other inorganics) and other parameters identified as present in K028, K095, and K096, respectively. The data presented in these tables were obtained from sampling and analysis conducted by the land disposal restrictions and relisting programs. No waste characterization data are available for K029.

2.3 Determination of Waste Treatability Groups

In cases where EPA believes that constituents present in wastes represented in different codes can be treated to similar concentrations using the same technology, the Agency may combine the wastes into one treatability group.

K028, K095, and K096 are all generated by the same industry (chlorinated organic chemicals industry) and the same process (production of 1,1,1-trichloroethane). K029 is not generated and therefore not considered in developing treatability groups.

Based on the waste characterization data presented in Tables 2-2, and 2-3, K095 and K096 contain the same constituents at similar concentrations. Furthermore, both wastes are recycled to the same or other processes. Based on these similarities, the Agency has determined that K095 and K096 represent a single treatability group.

K028 contains many of the same constituents at similar concentrations as those contained in K095 and K096; however, spent ferric chloride catalyst contained in K028 precludes recycle of this waste. Therefore, the Agency has determined that K028 represents a single waste treatability group.

Table 2-1

AVAILABLE CHARACTERIZATION DATA FOR K028

Source of Data:	Untreated Waste Concentration				Range
	(a)	(b)	(c)	(d)	
<u>BOAT LIST ORGANICS</u>					
<u>Volatiles</u>					
22. 1,1-Dichloroethane	•	•	1,082,000*	•	16,000-1,082,000*
25. trans-1,2-Dichloroethane	•	•	<50,000	•	ND-1,700
40. 1,1,1,2-Tetrachloroethane	•	•	<50,000	•	ND-200,000
41. 1,1,2,2-Tetrachloroethane	•	•	<50,000	•	ND-53,000
42. Tetrachloroethane	•	•	<50,000	•	ND-6,500
45. 1,1,1-Trichloroethane	•	•	<50,000	•	ND-1,900
46. 1,1,2-Trichloroethane	•	•	<50,000	•	ND-300,000
<u>Semivolatiles</u>					
111. Hexachlorobutadiene	•	•	<94	•	ND-170
113. Hexachloroethane	•	•	<94	•	ND-170
137. Pentachloroethane	•	•	ND	•	ND-6,900
<u>BOAT LIST METALS</u>					
156. Barium	---	---	17	---	17
158. Cadmium	---	---	0.6	---	0.6
159. Chromium (total)	---	---	109	---	109
160. Copper	---	---	132	---	132
161. Lead	---	---	42	---	42
163. Nickel	---	---	70	---	70
167. Vanadium	---	---	1.3	---	1.3
168. Zinc	---	---	78	---	78

(a) Relisting analytical data report (Reference 3).

(b) Relisting analytical data report (Reference 4).

(c) Characterization Report for Dow Chemical Company, Freeport, TX (Reference 1).

(d) Relisting analytical data report (Reference 2).

--- Not analyzed.

ND Not detected above the detection limit; detection limit not reported.

* Although quantitated at 108%, this value is estimated to range from 75-100%, based on discussions with laboratory personnel. Variability in this value is due to the quantity of this constituent in the sample and the dilution factor of 10,000,000 used to analyze this constituent within the calibration range of the instrument.

• This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 2-1 (Continued)
AVAILABLE CHARACTERIZATION DATA FOR K028

BOAT LIST METALS (TCLP)	Source of Data:	Untreated Waste Concentration				Range
		(a) (ppm)	(b) (ppm)	(c) (ppm)	(d) (ppm)	
154. Antimony	---	---	---	0.134	---	0.134
156. Barium	---	---	---	2.13	---	2.13
157. Beryllium	---	---	---	0.0049	---	0.0049
159. Chromium, total	---	---	---	1.33	---	1.33
160. Copper	---	---	---	4.21	---	4.21
161. Lead	---	---	---	1.17	---	1.17
162. Mercury	---	---	---	0.0012	---	0.0012
163. Nickel	---	---	---	4.63	---	4.63
167. Vanadium	---	---	---	0.353	---	0.353
168. Zinc	---	---	---	5.43	---	5.43
OTHER PARAMETERS						
Free Liquid (% by volume)	---	---	---	88**	---	88**
Flash Point (°F)	---	---	---	<77	---	<77
Density (g/ml)	---	---	---	1.2**	---	1.2**
Total Solids (%)	---	---	---	25.7	---	0.08-100***
Ash Content (%)	---	---	---	44.6	---	4.6
Oil and Grease (mg/kg)	---	---	---	33,500+	---	33,500+
Total Halogens (mg/l)	---	---	---	551,000	---	551,000
Heating Value (BTU/lb)	---	---	---	5,685	---	5,685
Viscosity (centistokes)	---	---	---	0.891	---	0.891

(a) Relisting analytical data report (Reference 3).
(b) Relisting analytical data report (Reference 4).
(c) Characterization Report for Dow Chemical Company, Freeport, TX (Reference 1).
(d) Relisting analytical data report (Reference 2).

--- Not analyzed.

ND Not detected above the detection limit; detection limit not reported.

* Although quantitated at 100%, this value is estimated to range from 75-100%, based on discussions with laboratory personnel. Variability in this value is due to the quantity of this constituent in the sample and the dilution factor of 10,000,000 used to analyze this constituent within the calibration range of the instrument.

** This value should be considered approximate due to the problems associated with rapid sample drying.

*** Measured on a dry basis.

* Liquid sample analyzed and treated as a solid. Results are reported on a wet as received basis.

* This information has been claimed as RCRA Confidential Business Information.
The information is available in the confidential portion of the Administrative Record for this rulemaking.

Table 2-1 (Continued)
AVAILABLE CHARACTERIZATION DATA FOR K028

Source of Data:	(a)	(b)	Untreated Waste Concentration (c)	(d)	Range
<u>OTHER PARAMETERS</u> (Continued)					
Chloride Content (mg/kg)	---	---	28,900+	---	28,900+
Carbon Content (%)	---	---	19.1	---	19.1
Biological Oxygen Demand (mg/l)	---	---	2,930++	---	2,930++
Chemical Oxygen Demand (mg/l)	---	---	281,000	---	281,000
Water Solubility	---	---	Insoluble	---	Insoluble
Manganese (ppm)	---	---	472	---	472
Sodium (ppm)	---	---	36	---	36
Silicon (ppm)	---	---	29	---	29

(a) Relisting analytical data report (Reference 3).
(b) Relisting analytical data report (Reference 4).
(c) Characterization Report for Dow Chemical Company, Freeport, TX (Reference 1).
(d) Relisting analytical data report (Reference 2).

--- Not analyzed.

ND Not detected above the detection limit; detection limit not reported.

* Although quantitated at 100%, this value is estimated to range from 75-100%, based on discussions with laboratory personnel. Variability in this value is due to the quantity of this constituent in the sample and the dilution factor of 10,000,000 used to analyze this constituent within the calibration range of the instrument.

** This value should be considered approximate due to the problems associated with rapid sample drying.

*** Measured on a dry basis.

+ Liquid sample analyzed and treated as a solid. Results are reported on a wet as received basis.

++ Result is probably biased low due to the suspected sample toxicity towards the BOD seed.

Table 2-2

AVAILABLE CHARACTERIZATION DATA FOR K095

Source of Data:

Untreated waste Concentration
(a)

BDAT LIST ORGANICS

This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

(a) Relisting analytical data report (Reference 2).

Table 2-3

AVAILABLE CHARACTERIZATION DATA FOR K096

Untreated Waste Concentration

Source of Data:

BDAT LIST ORGANICS

This information has been claimed as RCRA Confidential Business Information. The information is available in the confidential portion of the Administrative Record for this rulemaking.

(a) Relisting analytical data report (Reference 3).

3.0 APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

Available characterization data for K028, K095, and K096 were presented in Section 2.0 of this document. (No data are available for K029.) This section identifies the treatment technologies that are applicable to these wastes and determines which, if any, of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must be usable to treat the waste in question or to treat a waste that is similar in terms of parameters that affect treatment selection. Detailed descriptions of technologies that are demonstrated for listed hazardous wastes are presented in EPA's Treatment Technology Background Document. To be demonstrated, the technology must be employed in full-scale operation for the treatment of the waste in question or a similar waste. Technologies available only at pilot- and bench-scale operations are not considered in identifying demonstrated technologies.

3.1 Applicable Treatment Technologies

Since K028 nonwastewaters contain high concentrations of organic compounds (as shown in Section 2.0), applicable treatment technologies include those that destroy or reduce the total amount of various organic compounds in the waste. The Agency has identified the following treatment technologies as applicable for K028 nonwastewaters: incineration (fluidized bed and rotary kiln) followed by stabilization of incinerator ash and chemical precipitation

and filtration of scrubber water; solvent extraction followed by incineration or recycle of the extract; and critical fluid extraction followed by incineration of the contaminated solvents. Total recycle or reuse has been identified as an applicable treatment technology for K095 and K096 nonwastewaters. These treatment technologies were identified based on current waste treatment practices and engineering judgment. Since K095 wastewaters, K096 wastewaters, and K029 are not currently generated, the Agency has not identified applicable treatment technologies for these wastes.

The Agency recognizes that wastewater forms of K028 may also be generated from treatment technologies other than incineration. Since K028 wastewaters may contain hazardous organic constituents at treatable levels, applicable technologies include those that destroy or reduce the total amount of various organic compounds in the waste. Therefore, the Agency has identified the the following treatment technologies as potentially applicable for treatment of wastewater forms of K028: biological treatment, carbon adsorption, and solvent extraction.

Incineration. Incineration is a destruction technology in which energy, in the form of heat, is transferred to the waste to destabilize chemical bonds and destroy hazardous organic constituents. In a fluidized bed incinerator, waste is injected into the fluidized bed material (generally sand), where it is heated to its ignition temperature. Heat energy from the combustion reactions is then transferred back to the fluidized bed. In a rotary kiln incinerator, wastes are fed into the elevated end of the kiln; and

the rotation of the kiln mixes the waste with hot gases to heat the waste to its ignition temperature. Ash is removed from the lower end of the kiln. Combustion gases from the kiln enter the afterburner for complete destruction of waste constituents. Other wastes may also be injected into the afterburner. Combustion gases from the afterburner are then fed to a scrubber system for cooling and removal of entrained particulate and acid gases, if present. In general, two residuals are generated by incineration processes: ash and scrubber water. Metals and other inorganic constituents in incinerator ash and scrubber water can be treated using stabilization, and chemical precipitation and filtration, respectively.

Stabilization. Stabilization refers to a broad class of treatment processes that physically or chemically reduce the mobility of hazardous constituents in a waste by binding these constituents into a solid material that is resistant to leaching.

Chemical Precipitation and Filtration. Chemical precipitation and filtration are separation technologies in which metals are precipitated and removed from wastewaters. These technologies result in the formation of two treatment residuals: the treated wastewater and the precipitate. The precipitate may require further treatment by stabilization.

Solvent Extraction. Solvent extraction is a separation technology in which organics are removed from the waste due to greater constituent solubility in the solvent phase than in the waste phase. This technology

results in the formation of two treatment residuals: the treated waste residual and the extract. The extract may be recycled or treated further by incineration.

Critical Fluid Extraction. Critical fluid extraction is a solvent extraction technology in which the solvent is brought to its critical state to aid in the extraction of hazardous organic constituents from the wastes. After the extraction step, the solvent (liquified gas at critical state) is brought back to its normal condition in the gaseous state, and thus leaves a small volume of concentrated hazardous waste that is further treated by incineration.

Total Recycle or Reuse. Total recycle or reuse of a waste in the same process or another process eliminates the generation of the waste and generates no treatment residuals.

Biological Treatment. Biological treatment is a destruction technology by which hazardous organic constituents in wastewaters are biodegraded. This technology results in the formation of two treatment residuals: the treated effluent and waste biosludge. The waste biosludge may require further treatment for metals by stabilization.

Carbon Adsorption. Carbon adsorption is a separation technology by which hazardous organic constituents in wastewaters are selectively adsorbed onto activated carbon. This technology results in the formation of two

treatment residuals: the treated effluent and spent activated carbon. The spent carbon may require further treatment by incineration.

3.2 Demonstrated Treatment Technologies

Incineration is the demonstrated technology the Agency has identified for treatment of K028 nonwastewaters, including rotary kiln incineration and fluidized bed incineration. Rotary kiln incineration is demonstrated on a full-scale operational basis for treatment of K028 at two facilities. In addition, fluidized bed incineration is demonstrated on a full-scale basis for treatment of K028 at one facility. The Agency does not have treatment performance data for incineration of K028. However, for the BDAT program, the Agency tested rotary kiln incineration and fluidized bed incineration for other similar wastes as discussed in Section 4.1.

The Agency is not aware of any facilities that treat ash from incineration of K028 by stabilization or by any other technology. However, stabilization is demonstrated on wastes judged to be similar. The Agency evaluated stabilization of incinerator ash from treatment of two wastes using a pilot-scale stabilization process as discussed in Section 4.0 of this document. The Agency is not aware of any facilities that treat K028 or wastes judged to be similar on a full-scale operational basis using solvent extraction or critical fluid extraction; therefore, EPA believes that solvent

extraction and critical fluid extraction are not currently demonstrated for K028.

The Agency is not aware of any facilities that treat wastewater forms of K028. However, chemical precipitation sludge dewatering are demonstrated for wastewaters judged to be similar to scrubber water generated from the incineration of K028. The Agency tested lime and sulfide precipitation and vacuum filtration for a waste mixture at one facility as discussed in Section 4.0 of this document.

The demonstrated technology the Agency has identified for treatment of K095 and K096 nonwastewaters is total recycle or reuse.

K095 generated at one facility is reused directly as feed stock in another chlorinated hydrocarbon production unit. K096 generated at one facility is either used as feed stock for a perchloroethylene/trichloroethylene process or fed into a hydrochloric acid production furnace.

Since K029 is not currently generated, the Agency has not identified demonstrated treatment technologies for this waste. Demonstrated technologies for K095 and K096 wastewaters have not been identified.

4.0 TREATMENT PERFORMANCE DATA BASE

The Agency does not have any performance data for treatment of K028, K029, K095, or K096. Total recycle or reuse, the demonstrated technology identified for K095 and K096 nonwastewaters, does not result in the generation of a treatment residual. Therefore, numerical treatment standards developed based on treatment performance data are not applicable for K095 and K096 nonwastewaters. Since K095 wastewaters, K096 wastewaters, and K029 are not currently generated, numerical treatment standards for these wastes is also not applicable. For K028 nonwastewaters and wastewaters, treatment performance data were transferred from other previously-tested wastes to develop treatment standards. The basis for data transfer and the sources of treatment performance data are discussed below.

EPA's methodology for the transfer of treatment standards is included in a document entitled Methodology for Developing BDAT Treatment Standards. Transfer of treatment performance data is technically valid in cases where the untested wastes are generated from similar industries or similar processing steps, or have similar waste characteristics affecting treatment performance and treatment selection as the untested wastes. The basis of identifying applicable treatment technologies, presented in Section 3.0, is the particular parameters of the waste that will affect treatment selection. Wastes with similar waste characteristics are amenable to treatment by the same technology. Sources of treatment performance data for potential transfer to K028 include those wastes previously tested by rotary kiln or fluidized bed

incineration, followed by lime and flyash stabilization of incinerator ash, and lime and sulfide precipitation followed by vacuum filtration of scrubber water. (These technologies were identified as applicable and demonstrated for treatment of K028 in Section 3.0.)

4.1 Treatment of Organic Constituents

Incineration. Wastes previously tested by the Agency by rotary kiln or fluidized bed incineration include: K001, K019, K024, K037, K086, K087, K101, K102, F024, K048, and K051. EPA examined this list of wastes to identify the best data source(s), if any, for transfer of treatment data to K028. Specifically, EPA examined whether the untested wastes are generated from similar industries or processing steps and whether the wastes have similar waste characteristics affecting treatment performance.

F024, like K028, is generated by the chlorinated chemicals industry by separation steps from the product stream.

As discussed in the Treatment Technology Background Document, waste characteristics that affect treatment performance for rotary kiln and fluidized bed incineration include the thermal conductivity of the waste and the boiling points and bond dissociation energies of the constituents of concern. (Boiling points and bond dissociation energies for the constituents of concern for each waste are included in Appendix B.) K028 contains high concentrations of iron (as ferric chloride catalyst) and is therefore expected to have a

higher thermal conductivity than F024. The K028 waste constituents are also, in general, more volatile (i.e., have low boiling points) and have lower bond dissociation energies than waste constituents in F024. Therefore, based on thermal conductivity, boiling points, and bond dissociation energies, K028 is easier to treat than F024.

Based on these similarities, treatment standards for organic constituents in K028 nonwastewaters and wastewaters were developed from treatment performance data transferred from rotary kiln incineration of F024 at Plant A. Four different types of F024 wastes, two liquids and two solids, were treated at Plant A. The solid F024 wastes and waste biological sludge were fed to the rotary kiln, and the liquid F024 wastes, a waste organic liquid, and combustion gases from the kiln were fed to the afterburner. Therefore, ash generated from the rotary kiln represents treatment of the nonwastewaters only, while the scrubber water represents treatment of all the wastes fed to the incinerator. Table 4-1 (following this section) presents the BDAT List constituents that were detected in the untreated waste streams during rotary kiln incineration of F024 from plants E, F, G, and H, as well as waste biological sludge and an organic liquid that were burned with F024. Table 4-2 presents the BDAT List constituents detected in the kiln ash residual, and Table 4-3 presents the BDAT List constituents detected in the scrubber water residual. Tables 4-4 and 4-5 present design and operating data for the rotary kiln and the secondary combustor, respectively.

4.2 Treatment of Inorganic Constituents

Stabilization. EPA presented data for stabilization of metals in nonwastewaters in the California List Notice of Data Availability (52 Federal Register 29992, August 12, 1987). The Agency also has data for pilot-scale stabilization at Plant C of incinerator ash generated from fluidized bed incineration of K048 and K051 at Plant B. EPA screened these data to determine whether any wastes are generated from similar industries or similar processing steps or have similar waste characteristics as expected for ash generated from the incineration of K028. Lime and flyash stabilization of ash from the incineration of K048 and K051 wastes is the best source of data for transfer to stabilization of ash from the incineration of K028, since both wastes are ash generated from incineration of organic waste streams containing similar concentrations of metal constituents.

EPA then examined the relative treatability expected for ash generated from incineration of K028 and ash generated from incineration of K048 and K051. As discussed in Section 3.0, waste characteristics that affect treatment performance for stabilization include the presence of fine particulates, oil and grease, organic compounds, and inorganic compounds. Since both wastes (K028 and K048/K051) are incinerator ashes, oil and grease content and the presence of organic constituents are not considered to be significant. Both wastes are also expected to be similar in particle size. Ash for incineration of both wastes are expected to contain mixtures of various inorganic salts and metals and are expected to be equally amenable to treatment by stabilization.

Based on these analyses, EPA has transferred treatment performance data from stabilization of K048 and K051 nonwastewaters to K028 nonwastewaters. Treatment performance data for lime and flyash stabilization of ash from fluidized bed incineration of K048 and K051 are included in Table 4-6.

Lime and Sulfide Precipitation and Vacuum Filtration. EPA's database for chemical precipitation in wastewaters is included in the California List Notice of Data Availability (52 Federal Register 29992, August 12, 1987). EPA screened these data to determine whether any wastes were generated from similar industries or similar processing steps or had similar waste characteristics as expected for scrubber water generated from the incineration of K028. Based on the K028 waste characterization data included in Section 2.0, the constituents of concern are cadmium, chromium, lead, and nickel. Both K062 mixed with other metal-bearing characteristic wastes treated at Plant D and K028 scrubber water are wastewaters containing the constituents of concern at similar concentrations.

EPA then examined the relative treatability of K028 scrubber water and K062 wastewaters. As discussed in Section 3.0, waste characteristics that affect treatment performance for chemical precipitation include the concentrations and type of metals in the waste, the concentration of dissolved solids, the content of oil and grease, and whether the metal exists in the wastewater as a complex. As discussed above, both wastes are expected to contain the constituents of concern. Suspended solids, dissolved solids, and complexed metals are not considered to be significant parameters in either waste. Since

K028 scrubber water is generated from incineration, oil and grease is not considered to be significant. However, K062 wastewaters contain oil and grease and may therefore be more difficult to treat than K028 scrubber water.

Based on these analyses, transfer of performance data from K062 wastewaters to K028 wastewaters is valid. Treatment performance data for lime and sulfide precipitation followed by filtration from K062 and other metal-bearing wastes are included in Table 4-7.

Table 4-1

WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR F024 FROM
PLANTS E, F, G, AND H AND OTHER WASTES TREATED BY
ROTARY KILN INCINERATION

BDAT List Constituent	Concentration in Untreated Wastes Fed to the Rotary Kiln*		Concentration in Untreated Wastes Fed to the Secondary Combustor*		
	Plant G (ppm)	Plant H (ppm)	Plant E (ppm)	Plant F (ppm)	Organic Liquid (ppm)
222. Acetone	<0.05	<500	21,000	<20,000	<2,000
10. 2-Chloro-1,3-butadiene	<0.5	<5,000	139,721	<200,000	<20,000
14. Chloroform	<0.025	<250	<1,000	<10,000	<1,000
16. 3-Chloropropene	<0.5	<5,000	<20,000	285,486	<20,000
20. trans-1,4-Dichloro-2-butene	<0.5	<5,000	2,112	<200,000	<20,000
23. 1,2-Dichloroethane	<0.25	11,000	<1,000	<10,000	26,068
26. 1,2-Dichloropropane	<0.025	<250	<1,000	230,000	<1,000
27. trans-1,3-Dichloropropene	<0.025	<250	<1,000	290,000	<1,000
28. cis-1,3-Dichloropropene	<0.025	<250	<1,000	160,000	<1,000
34. Methyl ethyl ketone	<0.05	<250	2,200	<20,000	<2,000
38. Methylene chloride	ND	<250	<1,000	<10,000	1,884
42. Tetrachloroethene	0.3	<250	<1,000	<10,000	1,838
43. Toluene	<0.025	<250	<1,000	<10,000	25,930
45. 1,1,1-Trichloroethane	<0.025	<250	<1,000	<10,000	1,214
46. 1,1,2-Trichloroethane	<0.025	860	<1,000	<10,000	<1,000
49. 1,2,3-Trichloropropane	<0.025	<250	<1,000	9,712	<1,000
59. Benz(a)anthracene	0.89	ND	<172	<189	<196
62. Benzo(a)pyrene	0.6	<0.351	<172	<189	<196
63. Benzo(b)fluoranthene	0.72	ND	<172	<189	<196
64. Benzo(ghi)perylene	0.42	ND	<172	<189	<196

ND - Not detected; detection limit not available.

*F024 from Plants E and F were liquids; F024 from Plants G and H were sludges.

Source: ENSCO Onsite Engineering Report (Reference 6).

NOTE: The variation in detection limits was caused by the variation in the waste matrices.

Table 4-1 (Continued)

WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR F024 FROM
PLANTS E, F, G, AND H AND OTHER WASTES TREATED BY
ROTARY KILN INCINERATION

BDAT List Constituent	Concentration in Untreated Wastes Fed to the Rotary Kiln*			Concentration in Untreated Wastes Fed to the Secondary Combustor*		
	Plant G (ppm)	Plant H (ppm)	Sludge (ppm)	Plant E (ppm)	Plant F (ppm)	Organic Liquid (ppm)
65. Benzo(k)fluoranthene	0.87	<0.351	<134	<172	<189	<196
68. Bis(2-chloroethyl)ether	<0.351	32.4	<134	<172	<189	<196
70. Bis(2-ethylhexyl)phthalate	7.6	0.58	<134	<172	<189	<196
80. Chrysene	1.1	0.41	<134	<172	<189	<196
87. 1,3-Dichlorobenzene	<0.351	<0.351	<134	<172	<189	302
88. 1,4-Dichlorobenzene	<0.351	2.08	<134	<172	<189	<196
89. 3,3-Dichlorobenzidine	<1.76	<1.76	<266	<860	<945	915
92. Diethyl phthalate	0.05	<0.351	15.45	<172	<189	<196
110. Hexachlorobenzene	2.1	0.63	<134	<172	<189	<196
113. Hexachloroethane	0.44	<0.351	<134	<172	<189	<196
116. Indeno(1,2,3-cd)pyrene	0.41	<0.351	<134	<172	<189	<196
121. Naphthalene	ND	ND	1,500	<172	<189	<196
141. Phenanthrene	1.27	0.90	ND	<172	<189	<196
142. Phenol	<0.351	<0.351	<134	<172	<189	1,842
150. 1,2,4-Trichlorobenzene	<0.351	<0.351	<134	<172	<189	279
155. Arsenic	<1.0	2.0	<1.0	<1.0	<1.0	NA
156. Barium	34	6.8	35	0.27	0.30	NA
158. Cadmium	3.1	<0.4	3.1	<0.4	<0.4	NA
159. Chromium (total)	285	57	294	<0.4	<0.4	NA
160. Copper	45	800	46	<0.4	<0.4	NA

ND - Not detected; detection limit not available.

*F024 from Plants E and F were liquids; F024 from Plants G and H were sludges.
Source: ENSCO Onsite Engineering Report (Reference 6).

NOTE: The variation in detection limits was caused by the variation in the waste matrices.

Table 4-1 (Continued)

WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR F024 FROM
PLANTS E, F, G, AND H AND OTHER WASTES TREATED BY
ROTARY KILN INCINERATION

BDAT List Constituent	Concentration in Untreated Wastes Fed to the Rotary Kiln*			Concentration in Untreated Wastes Fed to the Secondary Combustor*		
	Plant G (ppm)	Plant H (ppm)	Sludge (ppm)	Plant E (ppm)	Plant F (ppm)	Organic Liquid (ppm)
161. Lead	9.0	3.8	10	<0.5	<0.5	NA
162. Mercury	0.19	<0.1	0.28	<0.1	<0.1	NA
163. Nickel	318	636	333	<0.9	<0.9	NA
165. Silver	<0.4	<0.4	0.56	<0.4	<0.4	NA
167. Vanadium	1.0	1.3	1.4	<0.3	<0.3	NA
168. Zinc	443	92	455	1.6	0.73	NA
169. Cyanide	<0.49	2.92	NA	<0.43	<0.44	NA
170. Fluoride	1.08	10.5	NA	<0.99	<1.00	NA
171. Sulfide	<4.8	<4.6	NA	9.1	7.8	NA
207. Hexachlorodibenzo-p-dioxins	0.01	0.002	NA	<1.4x10 ⁻⁶	<5.3x10 ⁻⁷	NA
208. Hexachlorodibenzofurans	0.003	0.05	NA	<7.1x10 ⁻⁷	<2.7x10 ⁻⁷	NA
209. Pentachlorodibenzo-p-dioxins	0.002	0.0003	NA	<1.4x10 ⁻⁶	<5.0x10 ⁻⁷	NA
210. Pentachlorodibenzofurans	0.002	0.03	NA	<5.1x10 ⁻⁷	<2.0x10 ⁻⁷	NA
212. Tetrachlorodibenzofurans	0.001	0.01	NA	<1.6x10 ⁻⁷	<1.6x10 ⁻⁷	NA

NA - Not analyzed.

ND - Not detected; detection limit not available.

*F024 from Plants E and F were liquids; F024 from Plants G and H were sludges.

Source: ENSCO Onsite Engineering Report (Reference 6).

NOTE: The variation in detection limits was caused by the variation in the waste matrices.

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FROM
ROTARY KILN INCINERATION OF F024 FROM PLANTS E, F, G, AND H
KILN ASH RESIDUAL

BDAT List Constituent	Concentration in Kiln Ash - Total Composition (mg/kg)						
	Sample Set #1	Sample Set #2	Sample Set #3	Sample Set #4	Sample Set #5	Sample Set #6	Range (mg/kg)
21. Dichlorodifluoromethane*	0.71	1.40	1.50	1.60	1.70	1.40	0.71-1.70
92. Diethyl phthalate**	0.67	0.67	0.67	0.60	0.45	1.14	0.45-1.14
170. Fluoride	NA	NA	2.11	NA	NA	NA	2.11
							Range (mg/l)
154. Antimony	0.062	<0.029	<0.029	<0.029	0.042	0.030	<0.029-0.062
155. Arsenic	0.079	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01-0.079
156. Barium	1.64	1.67	1.94	1.78	1.64	1.56	1.56-1.94
157. Beryllium	<0.001	0.002	0.001	0.002	0.002	0.001	<0.001-0.002
158. Cadmium	<0.004	0.037	0.033	0.028	0.016	0.027	<0.004-0.037
159. Chromium (total)	<0.004	0.28	0.29	0.31	0.32	0.13	<0.004-0.32
160. Copper	0.026	6.48	5.37	4.57	4.54	4.80	0.026-6.48
161. Lead	<0.032	1.2	29.3	22.0	21.6	1.25	<0.032-29.3
162. Mercury	0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	<0.0002-0.0003
163. Nickel	0.24	3.08	3.68	4.45	4.78	5.32	0.24-5.32
167. Vanadium	0.005	0.004	<0.003	0.008	<0.003	0.005	<0.003-0.008
168. Zinc	0.060	1.84	1.90	1.61	1.56	2.78	<0.060-2.78

NA - Not analyzed.

• This constituent was also detected in the laboratory blank at 0.27 ppm.

***This constituent was also detected in the laboratory blank at 0.51 ppm.

Source: ENSCO Onsite Engineering Report (Reference 6).

Table 4-3

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FROM
ROTARY KILN INCINERATION OF F024 FROM PLANTS E, F, G, AND H

SCRUBBER WATER RESIDUAL

BDAT List Constituent	Concentration in Scrubber Water - Total Composition (mg/l)					
	Sample Set #1	Sample Set #2	Sample Set #3	Sample Set #4	Sample Set #5	Sample Set #6
6. Bromomethane	<0.01	<0.01	<0.01	<0.01	<0.01	0.032
12. Chloroethane	<0.01	<0.01	<0.01	<0.01	<0.01	0.031
15. Chloromethane	<0.01	<0.01	<0.01	<0.01	<0.01	0.020
21. Dichlorodifluoromethane	<0.01	<0.01	0.29*	0.36*	0.40*	0.44*
50. Vinyl chloride	<0.01	<0.01	<0.01	<0.01	<0.01	0.026
92. Diethyl phthalate	ND	ND	ND	ND	0.057	ND
154. Antimony	11.3	12.3	9.27	10.8	7.94	8.72
155. Arsenic	0.48	<0.2	0.58	0.51	<0.1	<0.5
156. Barium	33.5	18.3	24.7	38.4	27.0	26.8
158. Cadmium	6.62	6.47	6.95	6.63	2.90	4.81
159. Chromium (total)	27.6	32.1	15.1	33.1	24.4	24.8
160. Copper	175	190	107	209	144	158
161. Lead	361	401	433	358	386	371
162. Mercury	0.31	0.20	0.45	0.29	0.42	0.34
163. Nickel	13.7	16.5	14.2	17.3	14.2	13.4
164. Selenium	3.08	1.09	<2.5	<2.5	<5.0	<0.5
165. Silver	10.9	10.7	10.1	9.45	7.12	5.38
167. Vanadium	1.05	1.72	0.37	1.84	1.52	0.97
168. Zinc	160	162	174	179	128	137
170. Fluoride	NA	NA	153	NA	NA	NA
207. Hexachlorodibenzo-p-dioxins	NA	NA	<7.2x10 ⁻⁶	NA	NA	NA
208. Hexachlorodibenzofurans	NA	NA	0.0003	NA	NA	NA
209. Pentachlorodibenzo-p-dioxins	NA	NA	<5.6x10 ⁻⁶	NA	NA	NA
210. Pentachlorodibenzofurans	NA	NA	0.0001	NA	NA	NA
212. Tetrachlorodibenzofurans	NA	NA	9.6x10 ⁻⁶	NA	NA	NA

NA - Not analyzed.

ND - Not detected; detection limit not available.

*This constituent was also detected in the laboratory blank at 0.23 ppm.

Table 4-4

DESIGN AND OPERATING DATA FOR THE ROTARY KILN AND SECONDARY COMBUSTOR FOR SAMPLE SETS 1 THROUGH 6

Parameter (units)	Design Value	Time of Data Collection					
		Sample Set #1 (11:20 am) (11:45 am)	Sample Set #2 (12:15 pm) (12:45 pm)	Sample Set #3 (1:15 pm) (1:45 pm)	Sample Set #4 (2:15 pm) (2:45 pm)	Sample Set #5 (3:15 pm) (3:45 pm)	Sample Set #6 (4:15 pm) (4:45 pm)
Kiln Outlet Temperature (°F)	1,000-1,700	1,391 1,255	1,393 1,405	1,360 1,604	1,425 1,413	1,452 1,450	1,207 1,551
Rotary Kiln Solid Waste Feed Rate ^a (lbs/minute)	NS	32 32	32 32	32 32	32 32	32 32	32 32
Kiln Rotational Speed ^b (RPM)	0.2-0.6	0.45 0.45	0.45 0.45	0.45 0.45	0.25 0.45	0.23 0.27	0.27 0.1
BTU Loading - Rotary Kiln (MMBTU/hour)	11	15 15	15 15	15 15	15 15	15 15	15 15
Secondary Combustor Temperature (°F)	1,800-2,200	2,025 2,021	2,056 2,142	2,132 1,990	2,093 2,119	2,123 2,126	2,006 1,877
Secondary Combustor Liquid Waste ^c Feed Rate (lbs/minute)	NS	18.2 27.7	29.2 27.7	29.4 32.3	25.9 25.6	29.6	13.4
BTU Loading-Rotary Kiln (MMBTU/hour)	19	9.5 14	15 14	15 17	14 13	15 13	7.0 0.6

^a This waste represents F024 from plants G and H and sludge that were treated by the rotary kiln incineration system.

^b The kiln rotational speed was decreased during the run to allow for a longer residence time of the kiln solids and to lower the temperature of the waste heat boiler.

^c This represents F024 from plants E and F and the organic liquid that were treated by the rotary kiln incineration system.

NS - Not specified.

Note: Kiln solids residence time is estimated to be 30-60 minutes. Secondary combustor residence time is estimated to be greater than 2 seconds. Both estimates are based on discussions with plant personnel.

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Table 4-5

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K048 AND K051,
PLANT C - LIME AND FLYASH STABILIZATION OF INCINERATOR ASH

Detected BDAT List Metal Constituents	Untreated Waste Concentration in TCLP Extracts of K048 and K051 Inciner- tor ash	Treated Waste Concentration in TCLP Extracts of Stabilized Fluidized Bed Incinerator Ash		
		Run 1 mg/L (ppm)	Run 2 mg/L (ppm)	Run 3 mg/L (ppm)
154. Antimony	0.06-0.09	<0.163	<0.163	<0.163
155. Arsenic	0.008-0.025	<0.004	<0.004	0.006
156. Barium	0.17-0.25	0.558	0.524	0.599
157. Beryllium	0.001	<0.001	<0.001	<0.001
158. Cadmium	<0.003	<0.003	<0.003	<0.003
159. Chromium (total)	2.1-2.6	1.13	1.21	1.08
221. Chromium (hexavalent)	NA	0.331	0.259	0.071
160. Copper	0.02	<0.003	<0.003	0.006
161. Lead	<0.05	<0.006	<0.006	<0.006
162. Mercury	0.0002-0.0003	NA	NA	NA
163. Nickel	0.02-0.03	<0.018	<0.018	<0.018
164. Selenium	0.033-0.12	0.013	0.016	0.017
165. Silver	<0.009	<0.006	<0.006	<0.006
166. Thallium	NA	<0.001	<0.001	<0.001
167. Vanadium	2.5-3.6	0.148	0.149	0.156
168. Zinc	0.055-0.11	0.02	0.022	0.052

NA - Not analyzed.

NP - Not applicable.

Table 4-5 (Continued)

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K048 AND K051,
PLANT C - LIME AND FLYASH STABILIZATION OF INCINERATOR ASH

<u>Design and Operating Parameters</u>	<u>Lime and Flyash Stabilization Process</u>		
	<u>Run 1</u>	<u>Run 2</u>	<u>Run 3</u>
Binder to Ash Ratio	NP	NP	NP
Lime to Ash Ratio	0.2	0.2	0.2
Flyash to Ash Ratio	0.2	0.2	0.2
Water to Ash Ratio	0.5	0.5	0.5
Ambient Temperature ($^{\circ}\text{C}$)	19	19	19
Mixture pH	12.0	12.1	12.1
Cure Time (Days)	28	28	28
Unconfined Compressive Strength (lb/in ²)	565.8	512.6	578.8

NA - Not analyzed.

NP - Not applicable.

Source: Waterways Onsite Engineering Report (Reference 7).

Table 4-6

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR K062,
PLANT D - LIME AND SULFIDE PRECIPITATION FOLLOWED BY VACUUM FILTRATION*

Detected BDAT List Metal Constituents	Sample Set #8		Sample Set #11		Sample Set #12	
	Untreated K062 Concentration (ppm)	Treated K062 Wastewater Concentration (ppm)	Untreated K062 Concentration (ppm)	Treated K062 Wastewater Concentration (ppm)	Untreated K062 Concentration (ppm)	Treated K062 Wastewater Concentration (ppm)
154. Antimony	<10	<1	<10	<1	<10	<1.00
155. Arsenic	<1	<0.1	<1	<0.1	<1	<0.10
156. Barium	<10	<1	<10	<1	12	<1.00
157. Beryllium	<2	<0.2	<2	<0.2	<2	<0.20
158. Cadmium	<5	<0.5	<5	<0.5	23	<5
221. Chromium (hexavalent)	0.13	<0.01	0.08	0.106	0.30	<0.01
159. Chromium (total)	831	0.15	395	0.12	617	0.18
160. Copper	217	0.16	191	0.14	137	0.24
161. Lead	212	<0.01	<10	<0.01	136	<0.01
162. Mercury	<1	<0.1	<1	<0.1	<1	<0.10
163. Nickel	669	0.36	712	0.33	382	0.39
164. Selenium	<10	<1	<10	<1	<10	<1.00
165. Silver	<2	<0.2	<2	<0.2	<2	<0.20
166. Thallium	<10	<1	<10	<1	<10	<1.00
168. Zinc	151	0.130	5	0.070	135	0.100

*Only three of the 12 data sets analyzed at Envirite represented treatment by this treatment train. Other data sets included pretreatment technologies such as chromium reduction and treatment for cyanide. These data are not included since K028 does not contain hexavalent chromium or cyanide.

Source: Envirite Onsite Engineering Report, Tables 6-1 to 6-12 (Reference 8).

5.0 IDENTIFICATION OF BEST DEMONSTRATED AND AVAILABLE TECHNOLOGY (BDAT)

This section presents the Agency's rationale for the determination of rotary kiln incineration followed by lime and flyash stabilization of incinerator ash, and lime and sulfide precipitation and vacuum filtration of scrubber water as the best demonstrated and available technology (BDAT) for K028; and the determination of total recycle or reuse as BDAT for K095 and K096 nonwastewaters. Since K095 and K096 wastewaters are not currently generated, and since the Agency is not proposing standards for these wastes at this time, BDAT for these wastes has not been determined. Since the Agency is proposing a standard of "No Land Disposal Based on No Generation" for K029, BDAT for this waste is not necessary.

As discussed in Section 3.0, the Agency has identified incineration, stabilization, and chemical precipitation and filtration as demonstrated technologies to be considered for BDAT for K028, and total recycle and reuse to be considered for BDAT for K095 and K096 nonwastewaters. In the absence of treatment performance data for K028, treatment performance data was transferred to K028 as discussed in Section 4.0.

For a treatment technology to be identified as BDAT, the performance data are first screened to determine whether they represented operation of a well-designed and well-operated treatment system, whether sufficient analytical quality assurance/quality control measures were employed to ensure the

accuracy of the data, and whether the appropriate measure of performance was used to assess the performance of the particular treatment technology.

The treatment performance data and the design and operating data collected during the test on the rotary kiln incineration of F024 at plant A, stabilization of K048 and K051 incinerator ash at plant C, and chemical precipitation followed by vacuum filtration at plant D were reviewed for the points described above. The appropriate measure of performance (i.e., total constituent concentration for incineration and chemical precipitation, and TCLP for stabilization) was used to assess the treatment systems. Additionally, the Agency had no reason to believe that the treatment systems at plants A, C, and D were not well-designed and well-operated, or that insufficient analytical quality assurance/quality control measures were employed in generating treatment performance data.

An available treatment technology is one that (1) is not a proprietary or patented process that cannot be purchased or licensed from the proprietor (in other words, it must be commercially available), and (2) substantially diminishes the toxicity of the waste or substantially reduces the likelihood of migration of hazardous constituents from the waste. The demonstrated technologies for treatment of K028, incineration (rotary kiln and fluidized bed incineration), stabilization, and chemical precipitation followed by vacuum filtration are considered to be commercially available. Total recycle and reuse, the demonstrated technologies for K095 and K096, are

also considered to be commercially available. These data were considered in the determination of BDAT for K028.

In cases where the Agency has treatment data for a waste for more than one technology, EPA uses the statistical method known as the analysis of variance, ANOVA (discussed in Reference 16), to determine if one technology performs significantly better than the rest. For K028, the Agency has treatment data for only one treatment system, and therefore an ANOVA comparison is not appropriate.

BDAT for K028 is rotary kiln incineration followed by lime and flyash stabilization of the ash; and lime and sulfide precipitation and vacuum filtration of the scrubber water. For K095 and K096 nonwastewaters, BDAT is total recycle or reuse based on current industrial practices.

This section presents the methodology and rationale for selection of the proposed regulated constituents in wastewater and nonwastewater forms of K028. Since numerical treatment standards are currently not being proposed for K029, K095, and K096, these wastes will not be discussed in this section.

Generally, constituents selected must satisfy the following criteria:

1. They must be on the BDAT List of constituents. (Presence on the BDAT List means that approved methods exist for analyzing the constituent in treated waste matrices.)
2. They must be present in or be suspected of being present in the untreated waste. For example, analytical difficulties may prevent a constituent from being identified in the untreated waste, but its identification in a treatment residual may lead the Agency to conclude that it is present in the untreated waste.
3. Where treatment performance data are transferred, the selected constituents must be as easy or easier to treat than the constituents from which performance data are transferred. Factors used to assess ease of treatment vary according to the technology of concern. For example, for incineration, the factors include bond dissociation energy, thermal conductivity, and boiling point.

The Agency initially considered for regulation all constituents on the BDAT List. Table 6-1 summarizes available waste characterization data for K028 for the BDAT List constituents (as derived from Table 2-1). Ranges of concentrations for constituents detected in the waste are shown in the table. If an analysis for a constituent was performed but the constituent was not detected in the waste, the table indicates "ND" for that constituent.

Constituents for which no analysis was performed are identified by "NA" (not analyzed). As discussed further below, a BDAT List constituent was deleted from consideration for regulation if: (1) the constituent was not detected in the untreated waste and is not suspected of being present in the waste because of analytical masking; (2) the constituent was not analyzed in the untreated waste; (3) detection limits or analytical results were not obtained for the constituent due to analytical or accuracy problems; (4) available treatment performance data for the constituent did not show effective treatment by BDAT; or (5) other reasons as discussed in Section 6.1.

6.1 Constituents That Were Not Selected for Proposed Regulation

BDAT List Constituents That Were Not Detected in the Untreated Waste. Constituents that were not detected in the untreated waste K028 (labeled "ND" in Table 6-1) were deleted from consideration for regulation. Since detection limits vary depending upon the nature of the waste matrix being analyzed, the detection limits determined in the characterization of K028 are included in Appendix D.

BDAT List Constituents That Were Not Analyzed in the Untreated Waste. Some constituents on the BDAT List were deleted from consideration for regulation because the untreated waste was not analyzed for these constituents (labeled "NA" in Table 6-1). Some constituents such as organochlorine pesticides, phenoxyacetic acid herbicides, organophosphorus insecticides,

PCBs, and dioxins and furans were not analyzed for in the untreated waste based on the judgment that it was extremely unlikely that the constituent would be present in the waste.

Constituents for Which Analytical Results Were Not Obtained Due to Analytical or Accuracy Problems Due to the Nature of Waste. Only one constituent on the BDAT List, hexavalent chromium, was deleted from consideration for regulation because of an analytical or accuracy problem (labeled "A" in Table 6-1). The analysis for total constituent concentration of hexavalent chromium could not be performed due to the oily nature of the K028 sample. Since total chromium was analyzed in the K028 sample, this analysis includes hexavalent chromium present in the sample, if any.

Hexavalent chromium was analyzed for but was not detected in the TCLP extract of the K028 sample.

Constituents for Which Available Treatment Performance Data Did Not Show Effective Treatment by BDAT. BDAT List constituents that were present in an untreated K028 but were not effectively treated by BDAT were deleted from consideration for regulation. Accordingly, barium, detected in untreated K028, was not considered further for regulation in wastewaters and nonwastewaters because the BDAT technologies for K028 do not provide effective treatment for this constituent. In addition, cadmium and lead were deleted from consideration for regulation in nonwastewaters because the Agency's data on stabilization of fluidized bed incinerator ash from incineration of K048 and K051 did not show effective treatment for these constituents.

Constituents Deleted From Consideration for Regulation for Other Reasons. Copper, vanadium, and zinc were considered for regulation in K028 wastewaters and nonwastewaters but were not selected as proposed regulated constituents. Although copper cyanide, vanadium pentoxide, and zinc cyanide are listed in Appendix VIII of 40 CFR Part 261, the metals are not listed individually. In this Second-Thirds proposed rulemaking, the Agency is only proposing to regulate copper, vanadium, and/or zinc when they are indicators of performance of treatment for Appendix VIII constituents. For K028, these metals (copper, vanadium, and zinc) have not been identified as indicators of performance of treatment for other Appendix VIII constituents and are therefore not being proposed for regulation.

6.2 Constituents Selected for Proposed Regulation

All of the organic and metal constituents that were further considered for regulation in K028 nonwastewaters and wastewaters have been selected for proposed regulation and are presented in Table 6-2.

Table 6-1

UNTREATED K028 ANALYZED FOR BDAT LIST CONSTITUENTS

		Detection Status (mg/kg)
<u>Volatiles</u>		
222.	Acetone	ND
1.	Acetonitrile	ND
2.	Acrolein	ND
3.	Acrylonitrile	ND
4.	Benzene	ND
5.	Bromodichloromethane	ND
6.	Bromomethane	ND
223.	n-Butyl alcohol	NA
7.	Carbon tetrachloride	ND
8.	Carbon disulfide	ND
9.	Chlorobenzene	ND
10.	2-Chloro-1,3-butadiene	ND
11.	Chlorodibromomethane	ND
12.	Chloroethane	ND
13.	2-Chloroethyl vinyl ether	ND
14.	Chloroform	ND
15.	Chloromethane	ND
16.	3-Chloropropene	ND
17.	1,2-Dibromo-3-chloropropane	ND
18.	1,2-Dibromoethane	ND
19.	Dibromomethane	ND
20.	trans-1,4-Dichloro-2-butene	ND
21.	Dichlorodifluoromethane	ND
22.	1,1-Dichloroethane	16,000-1,082,000*
23.	1,2-Dichloroethane	ND
24.	1,1-Dichloroethylene	ND
25.	trans-1,2-Dichloroethene	ND-1,700
26.	1,2-Dichloropropane	ND

NA - Not analyzed.

ND - Not detected.

* - Although quantitated at 108%, this value is estimated to range from 75-100% based on discussions with laboratory personnel. Variability in this value is due to the quantity of this constituent in the sample and the dilution factor of 10,000,000 used to analyze this constituent within the calibration range of the instrument.

Table 6-1 (Continued)

UNTREATED K028 ANALYZED FOR BDAT LIST CONSTITUENTS

	Detection Status (mg/kg)
<u>Volatiles</u> (Continued)	
27. trans-1,3-Dichloropropene	ND
28. cis-1,3-Dichloropropene	ND
29. 1,4-Dioxane	ND
224. 2-Ethoxyethanol	NA
225. Ethyl acetate	NA
226. Ethyl benzene	ND
30. Ethyl cyanide	ND
227. Ethyl ether	NA
31. Ethyl methacrylate	ND
214. Ethylene oxide	ND
32. Iodomethane	ND
33. Isobutyl alcohol	ND
37. Methacrylonitrile	ND
228. Methanol	NA
34. Methyl ethyl ketone	ND
229. Methyl isobutyl ketone	ND
35. Methyl methacrylate	ND
38. Methylene chloride	ND
230. 2-Nitropropane	NA
39. Pyridine	ND
40. 1,1,1,2-Tetrachloroethane	ND-200,000
41. 1,1,2,2-Tetrachloroethane	ND-53,000
42. Tetrachloroethene	ND-6,500
43. Toluene	ND
44. Tribromomethane	ND
45. 1,1,1-Trichloroethane	ND-1,900
46. 1,1,2-Trichloroethane	ND-300,000
47. Trichloroethene	ND

NA - Not analyzed.

ND - Not detected.

Table 6-1 (Continued)

UNTREATED K028 ANALYZED FOR BDAT LIST CONSTITUENTS

	Detection Status (mg/kg)
<u>Volatiles</u> (Continued)	
48. Trichloromonofluoromethane	ND
49. 1,2,3-Trichloropropane	ND
231. 1,1,2-Trichloro-1,2,2-trifluoroethane	NA
50. Vinyl chloride	ND
215. 1,2-Xylene	ND
216. 1,3-Xylene	ND
217. 1,4-Xylene	ND
<u>Semivolatiles</u>	
51. Acenaphthalene	ND
52. Acenaphthene	ND
53. Acetophenone	ND
54. 2-Acetylaminofluorene	ND
55. 4-Aminobiphenyl	ND
56. Aniline	ND
57. Anthracene	ND
58. Aramite	ND
59. Benz(a)anthracene	ND
218. Benzal chloride	NA
60. Benzenethiol	ND
62. Benzo(a)pyrene	ND
63. Benzo(b)fluoranthene	ND
64. Benzo(ghi)perylene	ND
65. Benzo(k)fluoranthene	ND
66. p-Benzoquinone	ND
67. Bis(2-chloroethoxy)methane	ND
68. Bis(2-chloroethyl)ether	ND
69. Bis(2-chloroisopropyl)ether	ND
70. Bis(2-ethylhexyl)phthalate	ND
71. 4-Bromophenyl phenyl ether	ND
72. Butyl benzyl phthalate	ND
73. 2-sec-Butyl-4,6-dinitrophenol	ND

NA - Not analyzed.

ND - Not detected.

Table 6-1 (Continued)

UNTREATED K028 ANALYZED FOR BDAT LIST CONSTITUENTS

	Detection Status (mg/kg)
<u>Semivolatiles</u> (Continued)	
74. p-Chloroaniline	ND
75. Chlorobenzilate	ND
76. p-Chloro-m-cresol	ND
77. 2-Chloronaphthalene	ND
78. 2-Chlorophenol	ND
79. 3-Chloropropionitrile	ND
80. Chrysene	ND
81. ortho-Cresol	ND
82. para-Cresol	ND
232. Cyclohexanone	NA
83. Dibenz(a,h)anthracene	ND
84. Dibenzo(a,e)pyrene	ND
85. Dibenzo(a,i)pyrene	ND
86. m-Dichlorobenzene	ND
87. o-Dichlorobenzene	ND
88. p-Dichlorobenzene	ND
89. 3,3'-Dichlorobenzidine	ND
90. 2,4-Dichlorophenol	ND
91. 2,6-Dichlorophenol	ND
92. Diethyl phthalate	ND
93. 3,3-Dimethoxybenzidine	ND
94. p-Dimethylaminoazobenzene	ND
95. 3,3'-Dimethylbenzidine	ND
96. 2,4-Dimethylphenol	ND
97. Dimethyl phthalate	ND
98. Di-n-butyl phthalate	ND
99. 1,4-Dinitrobenzene	ND
100. 4,6-Dinitro-o-cresol	ND
101. 2,4-Dinitrophenol	ND
102. 2,4-Dinitrotoluene	ND
103. 2,6-Dinitrotoluene	ND
104. Di-n-octyl phthalate	ND
105. Di-n-propylnitrosamine	ND

NA - Not analyzed.

ND - Not detected.

Table 6-1 (Continued)

UNTREATED K028 ANALYZED FOR BDAT LIST CONSTITUENTS

	Detection Status (mg/kg)
<u>Semivolatiles</u> (Continued)	
106. Diphenylamine	ND
219. Diphenylnitrosamine	ND
107. 1,2-diphenylhydrazine	ND
108. Fluoranthene	ND
109. Fluorene	ND
110. Hexachlorobenzene	ND
111. Hexachlorobutadiene	ND-170
112. Hexachlorocyclopentadiene	ND
113. Hexachloroethane	ND-170
114. Hexachlorophene	ND
115. Hexachloropropene	ND
116. Indeno(1,2,3-cd)pyrene	ND
117. Isosafrole	ND
118. Methapyrilene	ND
119. 3-Methylcholanthrene	ND
120. 4,4'-Methylenebis (2-chloroaniline)	ND
36. Methyl methanesulfonate	ND
121. Naphthalene	ND
122. 1,4-Naphthoquinone	ND
123. 1-Naphthylamine	ND
124. 2-Naphthylamine	ND
125. p-Nitroaniline	ND
126. Nitrobenzene	ND
127. 4-Nitrophenol	ND
128. N-Nitrosodi-n-butylamine	ND
129. N-Nitrosodiethylamine	ND
130. N-Nitrosodimethylamine	ND
131. N-Nitrosomethylethylamine	ND
132. N-Nitrosomorpholine	ND
133. N-Nitrosopiperidine	ND
134. N-Nitrosopyrrolidine	ND
135. 5-Nitro-o-toluidine	ND
136. Pentachlorobenzene	ND

ND - Not detected.

Table 6-1 (Continued)

UNTREATED K028 ANALYZED FOR BDAT LIST CONSTITUENTS

	Detection Status (mg/kg)
<u>Semivolatiles</u> (Continued)	
137. Pentachloroethane	ND-6,900
138. Pentachloronitrobenzene	ND
139. Pentachlorophenol	ND
140. Phenacetin	ND
141. Phenanthrene	ND
142. Phenol	ND
220. Phthalic anhydride	NA
143. 2-Picoline	ND
144. Pronamide	ND
145. Pyrene	ND
146. Resorcinol	ND
147. Safrole	ND
148. 1,2,4,5-Tetrachlorobenzene	ND
149. 2,3,4,6-Tetrachlorophenol	ND
150. 1,2,4-Trichlorobenzene	ND
151. 2,4,5-Trichlorophenol	ND
152. 2,4,6-Trichlorophenol	ND
153. Tris(2,3-dibromopropyl)phosphate	ND
<u>Metals*</u>	
154. Antimony	ND
155. Arsenic	ND
156. Barium	17
157. Beryllium	ND
158. Cadmium	0.6
159. Chromium (total)	109
221. Chromium (hexavalent)	A
160. Copper	132
161. Lead	42
162. Mercury	ND
163. Nickel	70

*Only one sample analyzed for metals.

NA - Not analyzed.

ND - Not detected.

A - Analysis could not be performed due to the oily nature of the sample.

Table 6-1 (Continued)

UNTREATED K028 ANALYZED FOR BDAT LIST CONSTITUENTS

	Detection Status (mg/kg)
<u>Metals</u> (Continued)	
164. Selenium	ND
165. Silver	ND
166. Thallium	ND
167. Vanadium	1.3
168. Zinc	78
<u>Inorganics</u>	
169. Cyanide	ND
170. Fluoride	NA
171. Sulfide	ND
<u>Organochlorine Pesticides</u>	
172. Aldrin	NA
173. alpha-BHC	NA
174. beta-BHC	NA
175. delta-BHC	NA
176. gamma-BHC	NA
177. Chlordane	NA
178. DDD	NA
179. DDE	NA
180. DDT	NA
181. Dieldrin	NA
182. Endosulfan I	NA
183. Endosulfan II	NA
184. Endrin	NA
185. Endrin aldehyde	NA
186. Heptachlor	NA
187. Heptachlor epoxide	NA
188. Isodrin	NA
189. Kepone	NA

NA - Not analyzed.

ND - Not detected.

Table 6-1 (Continued)

UNTREATED K028 ANALYZED FOR BDAT LIST CONSTITUENTS

	Detection Status (mg/kg)
<u>Organochlorine Pesticides (Continued)</u>	
190. Methoxychlor	NA
191. Toxaphene	NA
<u>Phenoxyacetic Acid Herbicides</u>	
192. 2,4-Dichlorophenoxyacetic acid	NA
193. Silvex	NA
194. 2,4,5-T	NA
<u>Organophosphorus Insecticides</u>	
195. Disulfoton	NA
196. Famphur	NA
197. Methyl parathion	NA
198. Parathion	NA
199. Phorate	NA
<u>PCBs</u>	
200. Aroclor 1016	NA
201. Aroclor 1221	NA
202. Aroclor 1232	NA
203. Aroclor 1242	NA
204. Aroclor 1248	NA
205. Aroclor 1254	NA
206. Aroclor 1260	NA
<u>Dioxins and Furans</u>	
207. Hexachlorodibenzo-p-dioxins	NA
208. Hexachlorodibenzofuran	NA
209. Pentachlorodibenzo-p-dioxins	NA
210. Pentachlorodibenzofuran	NA
211. Tetrachlorodibenzo-p-dioxins	NA
212. Tetrachlorodibenzofuran	NA
213. 2,3,7,8-Tetrachlorodibenzo-p-dioxin	NA

NA - Not analyzed.

Table 6-2

BDAT LIST CONSTITUENTS SELECTED FOR REGULATION
IN K028 WASTEWATERS AND NONWASTEWATERS

<u>Nonwastewaters</u>	<u>Wastewaters</u>
22. 1,1-Dichloroethane	22. 1,1-Dichloroethane
25. trans-1,2-Dichloroethene	25. trans-1,2-Dichloroethene
40. 1,1,1,2-Tetrachloroethane	40. 1,1,1,2-Tetrachloroethane
41. 1,1,2,2-Tetrachloroethane	41. 1,1,2,2-Tetrachloroethane
42. Tetrachloroethene	42. Tetrachloroethene
45. 1,1,1-Trichloroethane	45. 1,1,1-Trichloroethane
46. 1,1,2-Trichloroethane	46. 1,1,2-Trichloroethane
111. Hexachlorobutadiene	111. Hexachlorobutadiene
113. Hexachloroethane	113. Hexachloroethane
137. Pentachloroethane	137. Pentachloroethane
159. Chromium (total)	158. Cadmium*
163. Nickel	159. Chromium (total)
	161. Lead*
	163. Nickel

*Proposed of wastewaters only.

The Agency bases numerical treatment standards for constituents on the performance of well-designed and well-operated BDAT treatment systems. These standards must account for analytical limitations in available treatment performance data and the data must be adjusted for variabilities related to treatment, sampling, and analytical techniques and procedures. The purpose of this section is to calculate proposed treatment standards for K028 wastewaters and nonwastewaters for the constituents identified in Section 6.0 using the available treatment performance data from the BDAT treatment technologies. Included in this section is a step-by-step discussion of the calculation of proposed treatment standards for K028. Since numerical treatment standards are currently not being proposed for K029, K095, and K096, these wastes will not be discussed in this section.

Proposed BDAT treatment standards for K028 nonwastewaters and wastewaters are based on the demonstrated technologies of rotary kiln incineration, fluidized bed incineration followed by stabilization, and lime and sulfide precipitation followed by vacuum filtration. Ten BDAT List organics and two metals are being proposed for regulation in K028 nonwastewaters, and ten BDAT List organics and four metals are being proposed for regulation in K028 wastewaters.

Before treatment standards are calculated, the treatment performance data are corrected to account for analytical interferences associated with the

chemical matrix of the sample. A complete discussion of the accuracy correction of treatment data can be found in Appendix C. Appendix C also contains the matrix spike recoveries and accuracy correction factors used to correct the data, as well as the corrected treatment performance data.

After treatment performance data are corrected for accuracy, the arithmetic average of the corrected values for each constituent is calculated. In cases where the constituent is not detected above the detection limit, the detection limit is used to calculate the average. Tables 7-1 through 7-4 (following this section) present the averages of the corrected treatment performance data for each constituent being proposed for regulation in K028.

The next step in calculating treatment standards is determining of the variability factor (VF) for each constituent. The variability factor represents the variability inherent in performance of the treatment systems, collection of treated residuals, and analysis of samples. A complete discussion of the determination of variability factors can be found in an EPA document entitled Methodology for Developing BDAT Treatment Standards. The variability factors for the constituents proposed for regulation in K028 are shown in Tables 7-1 through 7-4.

Finally, the treatment standard for each constituent is calculated by multiplying the average of the corrected treatment performance values by the variability factor. Proposed treatment standards for K028 are presented in Tables 7-1 through 7-4 and are discussed in greater detail below.

7.1 Calculation of Treatment Standards for Nonwastewater Forms of K028

7.1.1 BDAT List Organics

Treatment performance data from rotary kiln incineration of K028 are not available. Therefore, the Agency is proposing to transfer performance data from treatment of F024 at Plant A to K028. The rationale for this transfer is presented in Section 4.0.

Incineration generally results in the generation of ash (a nonwastewater form of K028) and combustion gas scrubber water (a wastewater form of K028). The best measure of performance for a destruction technology, such as incineration, is the total amount of each constituent of concern remaining after treatment. Therefore, proposed BDAT treatment standards for organic constituents in K028 nonwastewaters were calculated based on total constituent concentration data from the treated waste, F024.

Six sets of data for rotary kiln incineration of F024 were used to calculate the proposed treatment standards for organic constituents in K028 nonwastewaters. Tables 4-1 and 4-2 of Section 4.0 present the total concentration values of each organic constituent detected in untreated F024 and the treated nonwastewater residual, respectively. Treatment performance data for each constituent proposed for regulation in F024 were transferred from data for the same constituent in F024 if that constituent was detected in the untreated F024. For a constituent not detected in the untreated F024, a

treatment standard was developed based on treatment performance data from another constituent that was detected in the untreated F024 that was tested.

The particular constituent from which data are transferred is determined based on the characteristics of the waste that affect the performance of treatment by incineration with respect to the nonwastewater residual (i.e., incinerator ash). In the rotary kiln, energy in the form of heat is transferred to the waste to volatilize the organic waste constituents. In determining whether one constituent is equally or more difficult to volatilize than another, the Agency examines the boiling points of the constituents.

In general, the Agency believes that a constituent having a higher boiling point is more difficult to treat than a constituent with a lower boiling point. Therefore, data were transferred from a constituent detected in untreated F024 fed to the kiln that had an equal or higher boiling point. Specific cases where data were transferred from another constituent are summarized below and are noted in Table 7-1 at the end of this section. Table 7-1 also shows the calculation of the treatment standard for each constituent being proposed for regulation. Boiling points for each constituent are presented in Appendix B.

22. 1,1-Dichloroethane - The proposed treatment standard for 1,1-dichloroethane (bp 57.15°C) in K028 is based on data transferred from treatment of 1,2-dichloroethane (bp 83.5°C) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration,

the Agency expects that 1,1-dichloroethane can be treated to concentrations as low as or lower than 1,2-dichloroethane.

25. trans-1,2-Dichloroethene. The proposed treatment standard for trans-1,2-dichloroethene (bp 47.2°C) in K028 is based on data transferred from treatment of 1,2-dichloroethane (bp 83.5°C) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that trans-1,2-dichloroethene can be treated to concentrations as low as or lower than 1,2-dichloroethane.

40. 1,1,1,2-Tetrachloroethane. The proposed treatment standard for 1,1,1,2-tetrachloroethane (bp 146.5°C) in K028 is based on data transferred from treatment of p-dichlorobenzene (bp 174°C) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1,1,2-tetrachloroethane can be treated to concentrations as low as or lower than p-dichlorobenzene.

41. 1,1,2,2-Tetrachloroethane. The proposed treatment standard for 1,1,2,2-tetrachloroethane (bp 146.75°C) in K028 is based on data transferred from treatment of p-dichlorobenzene (bp 174°C) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1,2,2-tetrachloroethane can be treated to concentrations as low as or lower than p-dichlorobenzene.

45. 1,1,1-Trichloroethane. The proposed treatment standard for 1,1,1-trichloroethane (bp 74°C) in K028 is based on data transferred from treatment of 1,2-dichloroethane (bp 83.5°C) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1,1-trichloroethane can be treated to concentrations as low as or lower than 1,2-dichloroethane.

111. Hexachlorobutadiene. The proposed treatment standard for hexachlorobutadiene (bp 215°C) in K028 is based on data transferred from treatment of hexachlorobenzene (bp 324.5°C) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that hexachlorobutadiene can be treated to concentrations as low as or lower than hexachlorobenzene.

137. Pentachloroethane. The treatment standard for pentachloroethane (bp 161.5°C) in K028 is based on data transferred from treatment of p-dichlorobenzene (bp 174°C) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that pentachloroethane can be treated to concentrations as low as or lower than p-dichlorobenzene.

7.1.2 BDAT List Metals

The Agency does not have treatment performance data for metals in K028 nonwastewaters. Proposed BDAT treatment standards for metals in K028

nonwastewaters were developed based on treatment performance data transferred from stabilization of incinerator ash from fluidized bed incineration of K048 and K051. The rationale for this transfer is presented in Section 4.0.

Stabilization reduces the leachability of metals in the waste. The best measure of performance for stabilization technologies is the analysis of the toxicity characteristic leaching procedure (TCLP) extract. Therefore, the proposed BDAT treatment standards for metals in nonwastewater forms of K028 were calculated based on TCLP data.

Three data sets for lime and fly ash stabilization of K048 and K051 were used to calculate treatment standards for metal constituents in K028 nonwastewaters. Table 4-6 of Section 4.0 presents the TCLP values for metal constituents in the stabilized K048 and K051 incinerator ash. Table 7-2 (at the end of this section) presents the data corrected for accuracy and treatment standard calculations for metal constituents being proposed for regulation in K028 nonwastewaters.

7.2 Calculation of Treatment Standards for Wastewater Forms of K028

7.2.1 BDAT List Organics

Treatment performance data for the wastewater residual, scrubber water, from rotary kiln incineration of K028 are not available. Therefore, the Agency is proposing to transfer data from treatment of F024 at Plant A to

develop treatment standards for K028. The rationale for this transfer is presented in Section 4.0.

The best measure of performance for a destruction technology, such as incineration, is the total amount of each constituent of concern remaining after treatment. Therefore, proposed BDAT treatment standards for organic constituents in K028 wastewaters were calculated based on total constituent concentration data from the treated waste F024.

Proposed treatment standards for K028 were calculated using six sets of data from rotary kiln incineration of F024. Tables 4-1 and 4-3 of Section 4.0 present the total concentrations of each organic constituent in the untreated F024 and the treated wastewater residual, respectively. Performance data for each constituent being selected for proposed regulation in K028 were transferred from data for the same constituent in F024 if that constituent was detected in the untreated F024. For a constituent not detected in the untreated F024, a treatment standard was developed based on treatment performance data from another constituent that was detected in the untreated F024 that was tested. The particular constituent from which data are transferred is determined based on the characteristics of the waste that affect the performance of treatment by incineration with respect to the wastewater residual (i.e., scrubber water). In the secondary chamber (or afterburner), energy in the form of heat is added to destabilize chemical bonds to initiate the combustion reactions. In determining whether one constituent is equally

or more difficult to destabilize than another, the Agency examines the bond dissociation energies of the constituents.

In general, the Agency believes that a constituent having a higher bond dissociation energy (BDE) is more difficult to treat than a constituent with a lower BDE. Therefore, data were transferred from a constituent that had an equal or higher BDE. Specific cases where data were transferred from another constituent are summarized below and are noted on Table 7-3 (at the end of this section). Table 7-3 also shows the calculation of the treatment standards for each BDAT List organic constituent being proposed for regulation in wastewaters. Bond dissociation energies for each constituent are presented in Appendix B.

22. 1,1-Dichloroethane. The proposed treatment standard for 1,1-dichloroethane (BDE 645 kcal/mol) in K028 is based on data transferred from treatment of 1,2-dichloroethane (BDE 645 kcal/mol) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1-dichloroethane can be treated to concentrations as low as or lower than 1,2-dichloroethane.

25. trans-1,2-Dichloroethene. The proposed treatment standard for trans-1,2-dichloroethene (BDE 505 kcal/mol) in K028 is based on data transferred from treatment of hexachloroethane (BDE 565 kcal/mol) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln

incineration, the Agency expects that trans-1,2-dichloroethene can be treated to concentrations as low as or lower than hexachloroethane.

40. 1,1,1,2-Tetrachloroethane. The proposed treatment standard for 1,1,1,2-tetrachloroethane (BDE 605 kcal/mol) in K028 is based on data transferred from treatment of 1,1,2-trichloroethane (BDE 625 kcal/mol) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1,1,2-tetrachloroethane can be treated to concentrations as low as or lower than 1,1,2-trichloroethane.

41. 1,1,2,2-Tetrachloroethane. The proposed treatment standard for 1,1,2,2-tetrachloroethane (BDE 605 kcal/mol) in K028 is based on data transferred from treatment of 1,1,2-trichloroethane (BDE 625 kcal/mol) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1,2,2-tetrachloroethane can be treated to concentrations as low as or lower than 1,1,2-trichloroethane.

45. 1,1,1-Trichloroethane. The proposed treatment standard for 1,1,1-trichloroethane (BDE 625 kcal/mol) in K028 is based on data transferred from treatment of 1,1,2-trichloroethane (BDE 625 kcal/mol) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that 1,1,1-trichloroethane can be treated to concentrations as low as or lower than 1,1,2-trichloroethane.

111. Hexachlorobutadiene. The proposed treatment standard for hexachlorobutadiene (BDE 855 kcal/mol) in K028 is based on data transferred from treatment of 1,2,3-trichloropropane (BDE 910 kcal/mol) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that hexachlorobutadiene can be treated to concentrations as low as or lower than 1,2,3-trichloropropane.

137. Pentachloroethane. The proposed treatment standard for pentachloroethane (BDE 585 kcal/mol) in K028 is based on data transferred from treatment of 1,1,2-trichloroethane (BDE 625 kcal/mol) in F024. Based on the waste characteristics that affect treatment performance of rotary kiln incineration, the Agency expects that pentachloroethane can be treated to concentrations as low as or lower than 1,1,2-trichloroethane.

7.2.2 BDAT List Metals

The Agency does not have treatment performance data for metals in K028 wastewaters. Proposed BDAT treatment standards for metals in K028 wastewaters were developed based on performance data transferred from treatment of K062 and metal-bearing characteristic wastes using lime and sulfide precipitation followed by vacuum filtration. The rationale for this transfer is presented in Section 4.0.

Lime and sulfide precipitation followed by vacuum filtration is a removal technology for metals in the wastewater residual. The best measure of

performance for a removal technology is the total amount of each constituent of concern remaining in the wastewater after treatment. Therefore, the proposed BDAT treatment standards for metals in wastewater forms of K028 were calculated based on total constituent concentration data from the treated wastewaters, K062, and other metal-bearing characteristic wastes.

Three data sets for lime and sulfide precipitation followed by vacuum filtration of K062 and metal-bearing characteristic wastes were used to calculate the treatment standards for metal constituents in K028 wastewaters. Table 4-7 in Section 4.0 presents the total concentrations for metal constituents in the untreated and treated K062 and metal-bearing characteristic wastes. Table 7-4 at the end of this section presents the data corrected for accuracy and treatment standard calculations for metal constituents being proposed for regulation in K028 wastewaters.

Table 7-1
CALCULATION OF PROPOSED TREATMENT STANDARDS FOR ORGANIC CONSTITUENTS IN K028 NONWASTEWATERS

Regulated Constituent (SW-846 Method Number)	Volatiles (8240) (Total Concentration) ¹	F024 Constituent From Which Treatment Data Were Transferred	Arithmetic Average of Corrected Treatment Performance Values (ppm)	Variability Factor (VF)	Treatment Standard (Average X VF) (ppm)
22. 1,1-Dichloroethane		1,2-Dichloroethane	0.005	2.8	0.014
25. trans-1,2-Dichloroethane		1,2-Dichloroethane	0.005	2.8	0.014
40. 1,1,1,2-Tetrachloroethane		p-Dichlorobenzene	0.686	2.8	1.9
41. 1,1,2,2-Tetrachloroethane		p-Dichlorobenzene	0.686	2.8	1.9
42. Tetrachloroethene		Tetrachloroethene	0.005	2.8	0.014
45. 1,1,1-Trichloroethane		1,2-Dichloroethane	0.005	2.8	0.014
46. 1,1,2-Trichloroethane		1,1,2-Trichloroethane	0.005	2.8	0.014
111. Hexachlorobutadiene		Hexachlorobenzene	0.95	2.8	2.7
113. Hexachloroethane		Hexachloroethane	0.634	2.8	1.8
137. Pentachloroethane		p-Dichlorobenzene	0.686	2.8	1.9

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¹For a detailed discussion of the analytical methods upon which these treatment standards are based, see the ENSCO Onsite Engineering Report.

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Table 7-2
CALCULATION OF PROPOSED TREATMENT STANDARDS FOR METAL CONSTITUENTS IN K028 NONWASTEWATERS

Regulated Constituent	Arithmetic Average of Corrected Treatment Per- centage Values (ppm)	Variability Factor (VF)	Treatment Standard (Average x VF) (ppm)
<u>Metals</u> <u>(TCLP)</u> 1			
159. Chromium (total)	1.48	1.14	1.7
163. Nickel	0.0268	1.79	0.048

For a detailed discussion of these treatment standards are based, see the Waterways Onsite Engineering Report (Reference 7).

Table 7-3

CALCULATION OF PROPOSED TREATMENT STANDARDS FOR ORGANIC CONSTITUENTS IN K028 WASTEWATERS

Regulated Constituent (SW-846 Method Number) ¹	F024 Constituent From Which Treatment Data Were Transferred	Arithmetic Average of Corrected Treatment Performance Values (ppm)	Variability Factor (VF)	Treatment Standard (Average X VF) (ppm)
<u>Volatiles (8240)</u>				
22. 1,1-Dichloroethane	1,2-Dichloroethane	0.005	2.8	0.014
25. trans-1,2-Dichloroethene	Hexachloroethane	0.013	2.8	0.036
40. 1,1,1,2-Tetrachloroethane	1,1,2-Trichloroethane	0.005	2.8	0.014
41. 1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	0.005	2.8	0.014
42. Tetrachloroethene	Tetrachloroethane	0.005	2.8	0.014
45. 1,1,1-Trichloroethane	1,1,2-Trichloroethane	0.005	2.8	0.014
46. 1,1,2-Trichloroethane	1,1,2-Trichloroethane	0.005	2.8	0.014
<u>Semivolatiles (8270)¹</u>				
111. Hexachlorobutadiene	1,2,3-Trichloropropane	0.005	2.8	0.014
113. Hexachloroethane	Hexachloroethane	0.013	2.8	0.036
137. Pentachloroethane	1,1,2-Trichloroethane	0.005	2.8	0.014

¹For a detailed discussion of the analytical methods upon which these treatment standards are based, see the ENSCO Onsite Engineering Report.

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Table 7-4

CALCULATION OF PROPOSED TREATMENT STANDARDS FOR METAL CONSTITUENTS IN K028 WASTEWATERS

Regulated Constituent (Total Concentration) ¹	Metals (ppm)	Arithmetic Average of Corrected Treatment Per- formance Values (ppm)	Variability Factor (VF)	Treatment Standard Average X VF (ppm)
158. Cadmium	2.29	2.29	2.8	6.4
159. Chromium (total)	0.221	0.221	1.58	0.35
161. Lead	0.0132	0.0132	2.8	0.037
163. Nickel	0.387	0.387	1.21	0.47

¹For a detailed discussion of these treatment standards are based, see the Enviro Onsite Engineering Report (Reference 8).

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1021-01.tir.2

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Appendix A

SUMMARY OF PLANT CODES

<u>Plant Code</u>	<u>Plant Name</u>	<u>Data Source</u>
A	Environmental Services Corporation El Dorado, Arkansas	EPA Testing (Reference 6)
B	Amoco Oil Company Whiting, IN	EPA Testing (Reference 18)
C	Waterways Experiment Station Vicksburg, MS	EPA Testing (Reference 7)
D	Envirite Corporation York, PA	EPA Testing (Reference 8)
E	DuPont Chemical Company LaPlace, LA	EPA Testing (Reference 6)
F	Shell Chemicals Norco, LA	EPA Testing (Reference 6)
G	Vista Chemicals Lake Charles, LA	EPA Testing (Reference 6)
H	Vulcan Chemicals Wichita, KS	EPA Testing (Reference 6)

Appendix B

WASTE CHARACTERISTICS AFFECTING PERFORMANCE

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List of boiling points for constituents of interest .	B-2
List of bond dissociation energies for constituents of interest	B-3

Appendix B

CONSTITUENT BOILING POINTS

<u>Constituent*</u>	<u>Boiling Point (°C)</u>
22. 1,1-Dichloroethane	57.15
23. 1,2-Dichloroethane	83.5
25. trans-1,2-Dichloroethene	47.2
40. 1,1,1,2-Tetrachloroethane	146.5
41. 1,1,2,2-Tetrachloroethane	146.75
42. Tetrachloroethene	121
45. 1,1,1-Trichloroethane	74
46. 1,1,2-Trichloroethane	113.5
68. Bis(2-chloroethyl)ether	178
80. Chrysene	448
88. p-Dichlorobenzene	174
110. Hexachlorobenzene	324.5
111. Hexachlorobutadiene	215
113. Hexachloroethane	186.9
116. Indeno (1,2,3-cd)pyrene	536
137. Pentachloroethane	161.5
141. Phenanthrene	340

*Identified by BDAT List number.

Sources: Merck Index (Reference 10).

Handbook of Environmental Data on Organic Chemicals (Reference 11).

Appendix B

BOND DISSOCIATION ENERGIES

<u>Constituents*</u>	<u>Bond Dissociation Energy (kcal/mole)</u>
222. Acetone	945
10. 2-Chloro-1,3-butadiene	955
14. Chloroform	340
16. 3-Chloropropene	810
20. trans-1,4-Dichloro-2-butene	1075
22. 1,1-Dichloroethane	645
23. 1,2-Dichloroethane	645
25. trans-1,2-Dichloroethene	505
26. 1,2-Dichloropropane	930
27. trans-1,3-Dichloropropene	790
28. cis-1,3-Dichloropropene	790
34. Methyl ethyl ketone	1230
38. Methylene chloride	360
40. 1,1,1,2-Tetrachloroethane	605
41. 1,1,2,2-Tetrachloroethane	605
42. Tetrachloroethene	465
43. Toluene	1620
45. 1,1,1-Trichloroethane	625
46. 1,1,2-Trichloroethane	625
49. 1,2,3-Trichloropropane	910
59. Benz(a)anthracene	3680
62. Benzo(a)pyrene	4030
63. Benzo(b)fluoranthene	4030
64. Benzo(ghi)perylene	4360
65. Benzo(k)fluoranthene	4030
68. Bis(2-chloroethyl)ether	1290
70. Bis(2-ethylhexyl)phthalate	6465
80. Chrysene	3680
88. p-Dichlorobenzene	1325
92. Diethyl phthalate	3145
110. Hexachlorobenzene	1305
111. Hexachlorobutadiene	855
113. Hexachloroethane	565
116. Indeno(1,2,3-cd)pyrene	4580
121. Naphthalene	2120
137. Pentachloroethane	585
141. Phenanthrene	2900

*Identified by BDAT List number.

Sources: Sanderson, R.T. Chemical Bonds and Bond Energy (Reference 13).
Lange's Handbook of Chemistry (Reference 14).
Handbook of Chemistry and Physics (Reference 12).

Appendix C

ACCURACY CORRECTION OF TREATMENT DATA

The treatment performance data used to determine of treatment standards for K028 were adjusted to account for analytical interferences associated with the chemical matrix of the samples. Generally, performance data were corrected for accuracy as follows: (1) a matrix spike recovery was determined for each BDAT List constituent detected in the untreated or treated waste; (2) an accuracy correction factor was determined for each of the above constituents by dividing 100 by the matrix spike recovery (in percent) for that constituent; and (3) treatment performance data for each BDAT List constituent detected in the untreated or treated waste were corrected by multiplying the reported concentration of the constituent by the corresponding accuracy correction factor. The procedure for accuracy correction of the data is described in further detail below.

Matrix spike recoveries are developed by analyzing a sample of a treated waste for a constituent and then reanalyzing the sample after the addition of a known amount of the same constituent (i.e., spike) to the sample. The matrix spike recovery represents the total amount of constituent recovered after spiking, minus the initial concentration of the constituent in the sample, and the result divided by the known amount of constituent added.

Matrix spike recoveries used in adjustment of the treatment performance data that were transferred to K028 are shown in Tables C-1 through C-4. Duplicate matrix spikes were performed for some BDAT List constituents. If a duplicate matrix spike was performed for a constituent, the matrix spike recovery used for that constituent was the lower of the two values from the first matrix spike and the duplicate spike.

Where a matrix spike was not performed for an organic constituent, the matrix spike recovery for that constituent was derived from the average matrix spike recoveries of the appropriate group of constituents (volatile or semivolatile constituents) for which recovery data were available. In these cases, the matrix spike recoveries for all volatiles or semivolatiles from the first matrix spike were averaged. Similarly, an average matrix spike recovery was calculated for the duplicate matrix spike recoveries. The lower of the two average matrix spike recoveries of the volatile or semivolatile group was used for any volatile or semivolatile constituent for which no matrix spike was performed.

The accuracy correction factors for the data used in calculation of K028 treatment standards are presented in Tables C-5 and C-6. The corrected treatment concentrations for the constituents proposed for regulation in K028 wastewaters and nonwastewaters are presented in Tables C-7 and C-8.

Table C-1
MATRIX SPIKE RECOVERIES FOR KILN ASH RESIDUE (F024)

Spike Constituent	Sample Result			Duplicate Sample Result		
	Original Amount Found (ppm)	Amount Spiked (ppm)	Amount Recovered (ppm)	Percent Recovery ^a (ppm)	Amount Spiked (ppm)	Amount Recovered (ppm)
<u>VOLATILES</u>						
4. Benzene	<0.005	0.050	0.063	126	0.050	0.065
9. Chlorobenzene	<0.005	0.050	0.045	90	0.050	0.054
24. 1,1-Dichloroethene	<0.005	0.050	0.040	80	0.050	0.061
43. Toluene	<0.005	0.050	0.085	170	0.050	0.111
47. Trichloroethene	<0.005	0.050	0.089	178	0.050	0.108
AVERAGE RECOVERY FOR VOLATILES				159.6		
<u>SEMIVOLATILES (BASE/NEUTRAL FRACTION)</u>						
52. Acenaphthene	<0.577	0.050	0.015	30	0.044	0.088
88. 1,4-Dichlorobenzene	<0.577	0.050	0.038	72	0.045	0.080
102. 2,4-Dinitrotoluene	<0.577	0.050	0.019	38	0.050	0.100
105. N-Nitroso-di-n-propylamine	<0.577	0.050	0.055	110	0.059	0.118
145. Pyrene	<0.577	0.050	0.003	6	0.041	0.082
150. 1,2,4-Trichlorobenzene	<0.577	0.050	0.030	60	0.045	0.090
AVERAGE RECOVERY FOR SEMIVOLATILES (BASE/NEUTRAL FRACTION)				52.7	94.7	

^apercent recovery = $100 \times (C_i - C_0)/C_t$, where C_i = amount recovered, C_0 = original amount found, and C_t = amount spiked.

Table C-2

MATRIX SPIKE RECOVERIES FOR COMBUSTION GAS SCRUBBER DISCHARGE WATER (F024)

Spike Constituent	Sample Result			Percent Recovery (ppm)	Duplicate Sample Result		
	Original Amount Found (ppm)	Amount Spiked (ppm)	Amount Recovered (ppm)		Amount Spiked (ppm)	Amount Recovered (ppm)	Percent Recovery (ppm)
VOLATILES							
4. Benzene	<0.005	0.050	0.043	86	0.050	0.045	90
9. Chlorobenzene	<0.005	0.050	0.055	110	0.050	0.056	112
24. 1,1-Dichloroethene	<0.005	0.050	0.040	80	0.050	0.040	80
43. Toluene	<0.005	0.050	0.057	114	0.050	0.057	114
47. Trichloroethene	<0.005	0.050	0.053	106	0.050	0.054	108
AVERAGE RECOVERY FOR VOLATILES				99.2	100.8		
SEMIVOLATILES (BASE/NEUTRAL FRACTION)							
52. Acenaphthene	<0.012	0.050	0.039	78	0.050	0.032	64
88. 1,4-Dichlorobenzene	<0.012	0.050	0.032	64	0.050	0.029	58
102. 2,4-Dinitrotoluene	<0.012	0.050	0.057	114	0.050	0.057	114
105. N-Nitroso-di-n-propylamine	<0.012	0.050	0.066	132	0.050	0.058	116
145. Pyrene	<0.012	0.050	0.044	88	0.050	0.041	82
150. 1,2,4-Trichlorobenzene	<0.012	0.050	0.031	62	0.050	0.032	64
AVERAGE RECOVERY FOR SEMI-VOLATILES				89.7	85.7		

*Percent recovery = $100 \times (C_i - C_0)/C_i$, where C_i = amount recovered, C_0 = original amount found, and C_t = amount spiked.

Table C-3

MATRIX SPIKE RECOVERIES FOR THE TCLP EXTRACT FOR STABILIZED FLUIDIZED BED INCINERATOR ASH
(K048 AND K051)

CONSTITUENTS (ppm)	Lime and Flyash: Run 3			
	Original Amount Found (ppm)	Amount Spiked (ppm)	Amount Recovered (ppm)	Percent Recovery* (%)
BDAT METALS				
154. Antimony	<0.163	1.0	0.751	75
155. Arsenic	0.006	0.1	0.146	140
156. Barium	0.599	1.0	1.568	97
157. Beryllium	<0.001	1.0	0.728	73
158. Cadmium	<0.003	1.0	0.722	72
159. Chromium (total)	1.08	1.0	1.846	77
221. Chromium (hexavalent)	0.171	1.0	0.403	23
160. Copper	0.006	1.0	0.749	74
161. Lead	<0.006	1.0	0.72	72
163. Nickel	<0.018	1.0	0.698	70
164. Selenium	0.017	0.05	0.059	85
165. Silver	<0.006	1.0	0.726	73
166. Thallium	<0.001	1.0	0.583	58
167. Vanadium	0.156	1.0	1.092	94
168. Zinc	0.052	1.0	0.734	68

*Percent recovery = $100 \times (C_1 - C_0)/C_t$, where C_1 = amount recovered, C_0 = original amount found, and C_t = amount spiked.

Table C-4
MATRIX SPIKE RECOVERIES FOR METALS IN WASTEWATER RESIDUALS*

Spike Constituent	Original Amount Found (ppb)	Amount Spiked (ppb)	Sample Result		Duplicate Sample Result	
			Amount Recovered (ppb)	Percent Recovery [†] (%)	Amount Recovered (ppb)	Percent Recovery [†] (%)
158. Cadmium	4.2	25	26	87	27	91
159. Chromium (total)	<4.0	50	35	70	34	68
161. Lead	<5.0	25	22	88	19	76
163. Nickel	203	1,000	1,140	94	1,128	93

C_i

*Matrix spike recoveries transferred from the Onsite Engineering Report for Horsehead (Reference 9).

[†]Percent recovery = $100 \times (C_i - C_o)/C_t$, where C_i = amount recovered, C_o = original amount found, and C_t = amount spiked.

Table C-5

SUMMARY OF ACCURACY CORRECTION FACTORS FOR ORGANIC
CONSTITUENTS (F024)

Constituent	Accuracy Correction Factor*	
	Rotary	Scrubber Water
	Kiln Ash Residue Total Composition	Total Composition
222. Acetone	1.000	1.008
6. Bromomethane	NA	1.008
10. 2-Chloro-1,3-butadiene	1.00	1.008
12. Chloroethane	NA	1.008
15. Chloromethane	NA	1.008
16. 3-Chloropropene	1.000	1.008
20. trans-1,4-Dichloro-2-butene	1.000	1.008
21. Dichlorodifluoromethane	1.000	1.008
23. 1,2-Dichloroethane	1.000	1.008
26. 1,2-Dichloropropane	1.000	1.008
27. trans-1,3-Dichloropropene	1.000	1.008
28. cis-1,3-Dichloropropene	1.000	1.008
34. Methyl ethyl ketone	1.000	1.008
42. Tetrachloroethene	1.000	1.008
46. 1,1,2-Trichloroethane	1.000	1.008
49. 1,2,3-Trichloropropane	1.000	1.008
59. Benz(a)anthracene	1.899	1.167
62. Benzo(a)pyrene	1.899	1.167
63. Benzo(b)fluoranthene	1.899	1.167
64. Benzo(ghi)perylene	1.899	1.167
65. Benzo(k)fluoranthene	1.899	1.167
68. Bis(2-chloroethyl)ether	1.899	1.167
70. Bis(2-ethylhexyl)phthalate	1.899	1.167
80. Chrysene	1.899	1.167
88. 1,4-Dichlorobenzene	1.389	1.724
92. Diethyl phthalate	1.899	1.167
110. Hexachlorobenzene	1.899	1.167
113. Hexachloroethane	1.899	1.167
116. Indeno(1,2,3-cd)pyrene	1.899	1.167
141. Phenanthrene	1.899	1.167

*The Accuracy Correction Factor is equal to 100 divided by the percent recovery.

NA - Not Applicable.

Table C-6

SUMMARY OF ACCURACY CORRECTION FACTORS FOR METAL
CONSTITUENTS

<u>Constituent</u>	<u>Accuracy Correction Factor*</u>	
	<u>Line and Fly Ash Stabilization (K048 and K051)</u>	<u>Wastewater Metals+</u>
154. Antimony	1.33	--
155. Arsenic	0.71	--
156. Barium	1.03	--
157. Beryllium	1.37	--
158. Cadmium	1.39	1.149
159. Chromium (total)	1.31	1.471
160. Copper	1.35	--
161. Lead	1.39	1.316
163. Nickel	1.43	1.075
164. Selenium	1.18	--
165. Silver	1.38	--
167. Vanadium	1.07	--
168. Zinc	1.47	--

*The Accuracy Correction Factor is equal to 100 divided by the percent recovery.

+The data used to calculate these Accuracy Correction Factors were transferred from the Onsite Engineering Report for Horsehead (Reference 11).

Table C-7

CORRECTED DATA USED TO CALCULATE TREATMENT
STANDARDS FOR PROPOSED REGULATED CONSTITUENTS IN
K028 NONWASTEWATERS

Sample Set:	Corrected Total Concentration in the F024 Rotary Kiln Incinerator Ash, ppm*					
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
<u>Constituent</u>						
<u>Volatiles</u>						
22. 1,1-Dichloroethane	0.005	0.005	0.005	0.005	0.005	0.005
23. 1,2-Dichloroethane	0.005	0.005	0.005	0.005	0.005	0.005
25. trans-1,2-Dichloroethene	0.005	0.005	0.005	0.005	0.005	0.005
40. 1,1,1,2-Tetrachloroethane	0.732	0.801	0.656	0.676	0.625	0.625
41. 1,1,2,2-Tetrachloroethane	0.732	0.801	0.656	0.676	0.625	0.625
42. Tetrachloroethene	0.005	0.005	0.005	0.005	0.005	0.005
45. 1,1,1-Trichloroethane	0.005	0.005	0.005	0.005	0.005	0.005
46. 1,1,2-Trichloroethane	0.005	0.005	0.005	0.005	0.005	0.005
<u>Semivolatiles</u>						
88. p-Dichlorobenzene	0.732	0.801	0.656	0.676	0.625	0.625
110. Hexachlorobenzene	1.013	1.110	0.908	0.937	0.865	0.865
111. Hexachlorobutadiene	1.013	1.110	0.908	0.937	0.865	0.865
113. Hexachloroethane	0.630	0.630	0.664	0.630	0.625	0.625
137. Pentachloroethane	0.732	0.801	0.656	0.676	0.625	0.625
Corrected TCLP Concentration in the Stabilized K048 and K051 Incinerator Ash, ppm*						
Sample Set:	<u>1</u>	<u>2</u>	<u>3</u>			
<u>Metals</u>						
159. Chromium (total)	1.47	1.58	1.41			
163. Nickel	0.026	0.026	0.026			

*Constituent concentrations have been corrected by multiplying by the Accuracy Correction Factor (ACF) for each constituent.

Table C-8

CORRECTED DATA USED TO CALCULATE TREATMENT
STANDARDS FOR PROPOSED REGULATED CONSTITUENTS IN
K028 WASTEWATERS

		Corrected Total Concentration in the F024 Combustion Gas Scrubber Water, ppm*					
Sample Set:		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
<u>Constituent</u>							
<u>Volatiles</u>							
22.	1,1-Dichloroethane	0.005	0.005	0.005	0.005	0.005	0.005
23.	1,2-Dichloroethane	0.005	0.005	0.005	0.005	0.005	0.005
25.	trans-1,2-Dichloroethene	0.014	0.014	0.013	0.012	0.013	0.013
40.	1,1,1,2-Tetrachloroethane	0.005	0.005	0.005	0.005	0.005	0.005
41.	1,1,2,2-Tetrachloroethane	0.005	0.005	0.005	0.005	0.005	0.005
42.	Tetrachloroethene	0.005	0.005	0.005	0.005	0.005	0.005
45.	1,1,1-Trichloroethane	0.005	0.005	0.005	0.005	0.005	0.005
46.	1,1,2-Trichloroethane	0.005	0.005	0.005	0.005	0.005	0.005
49.	1,2,3-Trichloropropane	0.005	0.005	0.005	0.005	0.005	0.005

Semivolatiles

111. Hexachlorobutadiene	0.005	0.005	0.005	0.005	0.005	0.005
113. Hexachloroethane	0.014	0.014	0.013	0.012	0.013	0.013
137. Pentachloroethane	0.005	0.005	0.005	0.005	0.005	0.005

Corrected Total Concentration in the Treated
K062 Wastewater, ppm*

Metals	Sample Set:	1	2	3
158. Cadmium		0.575	0.575	5.747
159. Chromium (total)		0.221	0.176	0.265
161. Lead		0.013	0.013	0.013
163. Nickel		0.387	0.355	0.419

*Constituent concentrations have been corrected by multiplying by the Accuracy Correction Factor (ACF) for each constituent.

Appendix D

DETECTION LIMITS FOR K028 AND K095

	<u>Table Number</u>
Detection Limits for the Tarpot Bottoms Sample - K028 (Reference 1)	D-1
Detection Limits for the Spent Catalyst Sample - K028 (Reference 2)	D-2
Detection Limits for the 1,1,1-Trichloroethane Still Bottoms Sample - K095 (Reference 2)	D-3

TABLE D-1: DETECTION LIMITS FOR THE TARPOT BOTTOMS SAMPLE - K028

BOAT LIST CONSTITUENT	DETECTION LIMIT
VOLATILE CONSTITUENTS *	(ppm)
222 Acetone	100000
1 Acetonitrile	1000000
2 Acrolein	1000000
3 Acrylonitrile	1000000
4 Benzene	50000
5 Bromodichloromethane	50000
6 Bromomethane	100000
7 Carbon tetrachloride	50000
8 Carbon disulfide	50000
9 Chlorobenzene	50000
10 2-Chloro-1,3-butadiene	100000
11 Chlorodibromomethane	50000
12 Chloroethane	100000
13 2-Chloroethyl vinyl ether	100000
14 Chloroform	50000
15 Chloromethane	100000
16 3-Chloropropene	1000000
17 1,2-Dibromo-3-chloropropene	100000
18 1,2-Dibromoethane	50000
19 Dibromomethane	50000
20 Trans-1,4-dichloro-2-butene	1000000
21 Dichlorodifluoromethane	100000
22 1,1-Dichloroethane	50000
23 1,2-Dichloroethane	50000
24 1,1-Dichloroethylene	50000
25 Trans-1,2-dichloroethane	50000
26 1,2-Dichloropropane	50000
27 Trans-1,3-dichloropropane	50000
28 cis-1,3-Dichloropropane	50000
29 1,4-Dioxane	2000000
226 Ethyl benzene	50000
30 Ethyl cyanide	1000000
31 Ethyl methacrylate	1000000
214 Ethylene oxide	4000000
32 Iodomethane	500000
33 Isobutyl alcohol	2000000
34 Methyl ethyl ketone	50000
229 Methyl isobutyl ketone	100000

* - Volatiles analyses required a dilution factor of 10,000,000 to analyze and quantitate the target analytes within the calibration range of the instrument. Therefore, the detection limits for the volatiles are exceedingly high (some >100%) as shown in this table.

TABLE D-1: DETECTION LIMITS FOR THE TARPOT BOTTOMS SAMPLE - K028
(continued)

SDAT LIST CONSTITUENT	DETECTION LIMIT
VOLATILE CONSTITUENTS (continued) *	(ppm)
35 Methyl methacrylate	1000000
37 Methylacrylonitrile	1000000
38 Methylene chloride	50000
39 Pyridine	4000000
40 1,1,1,2-Tetrachloroethane	50000
41 1,1,2,2-Tetrachloroethane	50000
42 Tetrachloroethane	50000
43 Toluene	50000
44 Tribromomethane	50000
45 1,1,1-Trichloroethane	50000
46 1,1,2-Trichloroethane	50000
47 Trichloroethane	50000
48 Trichloromonofluoromethane	50000
49 1,2,3-Trichloropropane	50000
50 Vinyl chloride	100000
215 1,2-Xylene	50000
216 1,3-Xylene	50000
217 1,4-Xylene	50000
SEMIVOLATILE CONSTITUENTS	(ppm)
51 Acenaphthelene	94
52 Acenaphthene	94
53 Acetophenone	188
54 2-Acetylamino fluorene	188
55 4-Aminobiphenyl	188
56 Aniline	94
57 Anthracene	94
58 Aramite	NA
59 Benz(a)anthracene	94
60 Benzenethiol	NA
62 Benzo(a)pyrene	94
63 Benzo(b)fluoranthene	94
64 Benzo(g,h,i)perylene	94
65 Benzo(k)fluoranthene	94
66 p-Benzoquinone	NA

NA - The compound was searched using an NBS Library database of 42,000 compounds. The detection limit is not available.

* - Volatiles analyses required a dilution factor of 10,000,000 to analyze and quantitate the target analytes within the calibration range of the instrument. Therefore, the detection limits for the volatiles are exceedingly high (some >100%) as shown in this table.

TABLE D-1: DETECTION LIMITS FOR THE TARPOT BOTTOMS SAMPLE - K028
(continued)

BOAT LIST CONSTITUENT	DETECTION LIMIT
SEMIVOLATILE CONSTITUENTS (continued)	[ppm]
67 Bis[2-chloroethoxy]ethane	94
68 Bis[2-chloroethyl]ether	94
69 Bis[2-chloroisopropyl]ether	94
70 Bis[2-ethylhexyl]phthalate	94
71 4-Bromophenyl phenyl ether	94
72 Butyl benzyl phthalate	94
73 2-sec-Butyl-4,8-dinitrophenol	470
74 p-Chloroaniline	94
75 Chlorobenzilate	NA
76 p-Chloro-m-cresol	94
77 2-Chloronaphthalene	94
78 2-Chlorophenol	94
79 3-Chloropropionitrile	NA
80 Chrysene	94
81 ortho-Cresol	94
82 para-Cresol	94
83 Dibenz[a,h]anthracene	94
84 Dibenzo[a,e]pyrene	NA
85 Dibenzo[a,i]pyrene	NA
86 m-Dichlorobenzene	94
87 o-Dichlorobenzene	94
88 p-Dichlorobenzene	94
89 3,3'-Dichlorobenzidine	188
90 2,4-Dichlorophenol	94
91 2,6-Dichlorophenol	NA
92 Diethyl phthalate	94
93 3,3'-Dimethoxybenzidine	94
94 p-Dimethylethynylazobenzene	188
95 3,3'-Dimethylbenzidine	NA
96 2,4-Dimethylphenol	94
97 Dimethyl phthalate	94
98 Di-n-butyl phthalate	94
99 1,4-Dinitrobenzene	470
100 4,8-Dinitro-m-cresol	470
101 2,4-Dinitrophenol	470
102 2,4-Dinitrotoluene	94
103 2,6-Dinitrotoluene	94
104 Di-n-octyl phthalate	94
105 Di-n-propylnitrosamine	94
106 Diphenylamine	94
219 Diphenylnitrosamine	188
107 1,2-Diphenylhydrazine	470

NA - The compound was searched using an NIOS Library database of 42,000 compounds. The detection limit is not available.

TABLE D-1: DETECTION LIMITS FOR THE TARPOT BOTTOMS SAMPLE - K028
[continued]

BOAT LIST CONSTITUENT	DETECTION LIMIT
SEMIVOLATILE CONSTITUENTS (continued)	(ppm)
108 Fluoranthene	94
109 Fluorene	94
110 Hexachlorobenzene	94
111 Hexachlorobutadiene	94
112 Hexachlorocyclopentadiene	94
113 Hexachloroethane	94
114 Hexachlorophene	NA
115 Hexachloropropene	NA
116 Indeno[1,2,3-cd]pyrene	94
117 Isosafrole	188
118 Methapyrilene	NA
119 3-Methylcholanthrene	188
120 4,4'-Methylenebis(2-chloroaniline)	188
38 Methyl methanesulfonate	NA
121 Naphthalene	94
122 1,4-Naphthoquinone	NA
123 1-Naphthylamine	470
124 2-Naphthylamine	470
125 p-Nitroaniline	470
126 Nitrobenzene	94
127 4-Nitrophenol	470
128 N-Nitrosodi-n-butylamine	NA
129 N-Nitrosodiethylamine	NA
130 N-Nitrosodimethylamine	94
131 N-Nitrosomethylethylamine	94
132 N-Nitrosomorpholine	188
133 N-Nitrosopiperidine	94
134 N-Nitrosopyrrolidine	470
135 5-Nitro-o-toluidine	188
136 Pentachlorobenzene	NA
137 Pentachloroethane	NA
138 Pentachloronitrobenzene	940
139 Pentachlorophenol	470
140 Phenacetin	188
141 Phenanthrene	94
142 Phenol	94
143 2-Picoline	94
144 Pronamide	NA
145 Pyrene	94

NA - The compound was searched using an NBS Library database of 42,000 compounds. The detection limit is not available.

TABLE D-1: DETECTION LIMITS FOR THE TARPOT BOTTOMS SAMPLE - K028
(continued)

BDAT LIST CONSTITUENT	DETECTION LIMIT
SEMIVOLATILE CONSTITUENTS (continued)	(ppm)
146 Resorcinol	NA
147 Saffrole	470
148 1,2,4,5-Tetrachlorobenzene	188
149 2,3,4,6-Tetrachlorophenol	NA
150 1,2,4-Trichlorobenzene	94
151 2,4,5-Trichlorophenol	470
152 2,4,6-Trichlorophenol	94
153 Tri(2,3-dibromopropyl) phosphate	NA
METAL CONSTITUENTS	(ppm)
154 Antimony	2.1
155 Arsenic	1
156 Barium	0.1
157 Beryllium	0.2
158 Cadmium	0.3
159 Chromium, total	0.5
160 Copper	0.1
161 Lead	10
162 Mercury	0.1
163 Nickel	2.5
164 Selenium	0.5
165 Silver	0.1
166 Thallium	1000
167 Vanadium	0.2
168 Zinc	4
TCLP METAL CONSTITUENTS	(ppm)
154 Antimony	0.021
155 Arsenic	0.01
156 Barium	0.001
157 Beryllium	0.002
158 Cadmium	0.03
159 Chromium, total	0.005
221 Chromium, hexavalent	0.1
160 Copper	0.001
161 Lead	0.005
162 Mercury	0.0002
163 Nickel	0.025
164 Selenium	0.05
165 Silver	0.01
166 Thallium	0.01
167 Vanadium	0.02
168 Zinc	0.004

NA - The compound was searched using an NBS Library database of 42,000 compounds. The detection limit is not available.

TABLE D-1: DETECTION LIMITS FOR THE TARPOT BOTTOMS SAMPLE - K028
(continued)

BOAT LIST CONSTITUENT	DETECTION LIMIT
INORGANIC CONSTITUENTS	(ppm)
169 Cyanide	0.51
171 Sulfide	100

Sources: Dow Chemical Company Characterization Report (Reference 1).

TABLE D-2: DETECTION LIMITS FOR THE SPENT CATALYST SAMPLE - K029

BOAT LIST CONSTITUENT *	DETECTION LIMIT
VOLATILE CONSTITUENTS	(ppm)
222 Acetone	20000
2 Acrolein	NR
4 Benzene	10000
5 Bromodichloromethane	10000
7 Carbon tetrachloride	10000
9 Chlorobenzene	10000
12 Chloroethane	20000
13 2-Chloroethyl vinyl ether	20000
14 Chloroform	10000
15 Chloromethane	20000
16 3-Chloropropene	10000
20 Trans-1,4-dichloro-2-butene	10000
21 Dichlorodifluoromethane	NR
22 1,1-Dichloroethane	NR
23 1,2-Dichloroethane	10000
24 1,1-Dichloroethylene	10000
25 Trans-1,2-dichloroethane	10000
26 1,2-Dichloropropene	10000
27 Trans-1,3-dichloropropene	10000
28 cis-1,3-Dichloropropene	10000
228 Ethyl benzene	10000
34 Methyl ethyl ketone	20000
229 Methyl isobutyl ketone	NR
38 Methylene chloride	10000
40 1,1,1,2-Tetrachloroethane	NR
41 1,1,2,2-Tetrachloroethane	NR
42 Tetrachloroethane	NR
43 Toluene	10000
45 1,1,1-Trichloroethane	10000
46 1,1,2-Trichloroethane	10000
47 Trichloroethane	10000
48 Trichloromonofluoromethane	NR
49 1,2,3-Trichloropropene	10000
231 1,1,2-Trichloro-1,2,2-trifluoroethane	NR
50 Vinyl chloride	20000
215 1,2-Xylene	10000
216 1,3-Xylene	10000
217 1,4-Xylene	10000

TABLE D-2: DETECTION LIMITS FOR THE SPENT CATALYST SAMPLE - K028
(continued)

BDAT LIST CONSTITUENT *	DETECTION LIMIT
SEMIVOLATILE CONSTITUENTS	(ppm)
67 Bis(2-chloroethoxy)ethane	740
68 Bis(2-chloroethyl)ether	740
69 Bis(2-chloroisopropyl)ether	740
71 4-Bromophenyl phenyl ether	740
76 p-Chloro-m-cresol	740
77 2-Chloronaphthalene	740
78 2-Chlorophenol	740
86 m-Dichlorobenzene	740
87 o-Dichlorobenzene	740
88 p-Dichlorobenzene	740
90 2,4-Dichlorophenol	740
91 2,6-Dichlorophenol	740
110 Hexachlorobenzene	740
111 Hexachlorobutadiene	740
112 Hexachlorocyclopentadiene	740
113 Hexachloroethane	NR
115 Hexachloropropene	740
136 Pentachlorobenzene	740
137 Pentachloroethane	NR
139 Pentachlorophenol	3800
148 1,2,4,5-Tetrachlorobenzene	740
149 2,3,4,6-Tetrachlorophenol	740
150 1,2,4-Trichlorobenzene	740
151 2,4,5-Trichlorophenol	740
152 2,4,6-Trichlorophenol	3800

* BDAT constituents that are not listed were not analyzed.
NR Not reported.

Source: PPG Industries Analytical Data Report (Reference 18).

TABLE D-3: DETECTION LIMITS FOR THE 1,1,1-TRICHLOROETHANE STILL
BOTTOMS SAMPLE - K085

BOAT LIST CONSTITUENT *	DETECTION LIMIT
VOLATILE CONSTITUENTS	(ppm)
222 Acetone	20000
2 Acrolein	NR
4 Benzene	10000
5 Bromodichloromethane	10000
7 Carbon tetrachloride	10000
9 Chlorobenzene	10000
12 Chloroethane	20000
13 2-Chloroethyl vinyl ether	20000
14 Chloroform	10000
15 Chloromethane	20000
16 3-Chloropropene	10000
20 Trans-1,4-dichloro-2-butene	10000
21 Dichlorodifluoromethane	NR
22 1,1-Dichloroethane	10000
23 1,2-Dichloroethane	10000
24 1,1-Dichloroethylene	10000
25 Trans-1,2-dichloroethane	10000
26 1,2-Dichloropropene	10000
27 Trans-1,3-dichloropropene	10000
28 cis-1,3-Dichloropropene	10000
226 Ethyl benzene	10000
34 Methyl ethyl ketone	20000
229 Methyl isobutyl ketone	NR
38 Methylene chloride	10000
40 1,1,1,2-Tetrachloroethane	NR
41 1,1,2,2-Tetrachloroethane	NR
42 Tetrachloroethane	40000
43 Toluene	10000
45 1,1,1-Trichloroethane	10000
46 1,1,2-Trichloroethane	NR
47 Trichloroethane	NR
48 Trichloromonofluoromethane	NR
49 1,2,3-Trichloropropene	10000
231 1,1,2-Trichloro-1,2,2-trifluoroethane	NR
50 Vinyl chloride	20000
215 1,2-Xylene	10000
216 1,3-Xylene	10000
217 1,4-Xylene	10000

TABLE D-3: DETECTION LIMITS FOR THE 1,1,1-TRICHLOROETHANE STILL
BOTTOMS SAMPLE - K085
(continued)

BOAT LIST CONSTITUENT *	DETECTION LIMIT
SEMIVOLATILE CONSTITUENTS	[ppm]
87 Bis(2-chloroethoxy)ethane	740
88 Bis(2-chloroethyl)ether	740
89 Bis(2-chloroisopropyl)ether	740
71 4-Bromophenyl phenyl ether	740
76 p-Chloro-m-cresol	740
77 2-Chloronaphthalene	740
78 2-Chlorophenol	740
86 m-Dichlorobenzene	740
87 o-Dichlorobenzene	740
88 p-Dichlorobenzene	740
90 2,4-Dichlorophenol	740
91 2,6-Dichlorophenol	740
110 Hexachlorobenzene	740
111 Hexachlorobutadiene	740
112 Hexachlorocyclopentadiene	740
113 Hexachloroethane	NR
115 Hexachloropropene	740
136 Pentachlorobenzene	740
137 Pentachloroethane	NR
139 Pentachlorophenol	3800
148 1,2,4,5-Tetrachlorobenzene	740
149 2,3,4,6-Tetrachlorophenol	740
150 1,2,4-Trichlorobenzene	740
151 2,4,5-Trichlorophenol	3800
152 2,4,6-Trichlorophenol	740

* SDAT constituents that are not listed were not analyzed.
NR Not reported.

Sources: PPG Industries Analytical Data Report [Reference 18].